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THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

1935

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Bacteria, Food Elements and Caries—*Lyons*
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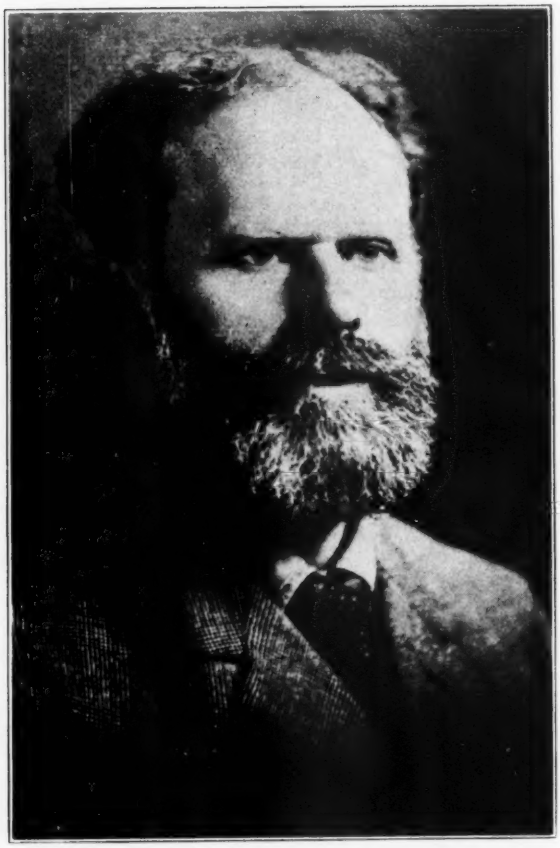

WILLOUGHBY DAYTON MILLER, D.D.S., Ph.D., M.D., D.Sc.

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Original Communications

WILLOUGHBY DAYTON MILLER: A RECORD OF HIS LIFE AND WORK*

By Wilhelm Dieck, Berlin, Germany

WILLOUGHBY Dayton Miller, born Aug. 1, 1853, was the son of a farmer living near Alexandria, Ohio, whose grandfather came to the United States from Germany. Miller died July 27, 1907, at a hospital in Newark, Ohio, after an operation for appendicitis. Having spent thirty-two years in Germany, he had returned to America to assume the deanship of the University of Michigan College of Dentistry, in the fall of 1907.

As a boy, he worked on the farm and attended the public school at Newark, Ohio. He entered the University of Michigan at Ann Arbor in 1871 to study natural science, and graduated there as a bachelor of arts, with distinction, in 1875. His intention was to apply himself entirely to mathematical physics, and to gain further experience he attended the lectures of Tait, Crum-Brown and others in Edinburgh, Scotland, during the winter of 1875-1876. Here, fate dealt him a hard blow: he lost all his money through the failure of a bank and was soon absolutely penniless in a foreign city. To obtain the necessities of life, he took a post as teacher of adults in a night school. During that winter, Miller lived almost entirely on potatoes and fish. An episode often related by Miller shows what kind of persons he had to teach. Owing to the nature of the pupils, the presence of two masters was always necessary in every classroom. One evening, a tumult arose in a neighboring classroom, and the head master, who was with Miller, hurried out to ascertain the cause. As soon as he disappeared through the door, Miller's pupils broke out in revolt, and made a move to leave the classroom. Miller rushed to the door and beat back the first who reached it, which so intimidated the others that they all returned to their places, and the lesson was quietly continued.

* Read at the Midwinter Clinic of the Chicago Dental Society, Feb. 28, 1934, by Arthur D. Black.

In the same year, 1876, Miller made his way to Berlin, where he found no means of improving his financial condition, and he consequently suffered extremely physically. Someone suggested that he call on his countryman, Dr. Abbot, a well-known dentist in Berlin, and he did this one evening, sick with hunger, without any means and without any prospects. Dr. Abbot saw him alone. On returning to his wife in another room, he said: "That is the kind of man I want for my daughter." His words showed a real knowledge of human nature and contained an unconscious prediction.

Dr. Abbot obtained for the young man a post as translator in an insurance office, and arranged that he should give instruction in natural sciences to Mrs. Abbot and their daughter. Miller lived in a room in the Universitats-Strasse, for which he paid ten marks a month, and he related afterwards that he debated one evening whether he should ask his landlady for something to spread on his bread or whether he should have his cuffs washed.

In the course of his visits to Dr. Abbot's house, Miller fell in love with Caroline Abbot, and it was solely his interest in her that determined Miller to change his profession. Dr. Abbot enabled him to study at the Pennsylvania College of Dental Surgery, Philadelphia, during the years 1877-1879. He there attracted the attention of the teachers and students by the ardor with which he devoted himself to his studies, by his quick comprehension and by the kindliness of his nature. He graduated in the spring of 1879, and was awarded the prize for the best work on "The Preservative Treatment of the Dental Pulp." Returning to Germany, he joined Dr. Abbot as his assistant, and he and Caroline Abbot were married, October 26 of the same year.

As far as his free time permitted, Miller attended further lectures at the university in the natural sciences and medicine, and, in the year 1881, at his father-in-law's suggestion, he published his first paper on dental science in the *Deutsche medizinische Wochenschrift,* the subject being "Electrical Processes in the Mouth." After intensive preparatory studies in bacteriology, he published in the following year a contribution in Kleb's *Archiv für Experimentelle Pathologie und Pharmakologie* on "The Agency of Micro-Organisms in Decay of Human Teeth." During the next few years, he devoted himself with untiring fervor to the study of bacteriology of the mouth and caries of the teeth.

In the autumn of 1884, Miller was appointed lecturer in the newly founded Dental Institute of Berlin University, with the title of professor. At first, he was looked on with mistrust by the dental profession, which was not particularly pleased that a foreigner should be appointed to a post to which quite a number of German dentists considered they had a just claim; but this mistrust was of short duration. It soon gave place to recognition of Miller's ability and scientific talents.

In 1885, the full qualification of a German dentist was bestowed on Miller, probably in consequence of those attacks in the professional journals based on the fact that the chair was occupied by a man who was not a German dentist. In the same year, the University of Michigan conferred on him the honorary degree of doctor of philosophy. Miller obtained the degree of doctor in the medical faculty of Berlin University with a dissertation on "Pathogenic Bacteria of the Human Mouth," and was appointed professor extraordinary in the medical faculty, in 1894. The highest scientific distinction, the honorary degree of doctor of science, was conferred on him in the year 1902.

by the University of Pennsylvania. When he retired from his professorial post in Berlin in October, 1906, he was granted the title of *Geheimer Medizinalrat*. He was the first university professor in dental surgery to receive this honor.

Miller can be fully appreciated only if his qualities as an academic teacher, a scientific investigator, a dental educator and a man are considered simultaneously. His most characteristic feature was an extraordinarily comprehensive scientific activity. No author in the domain of dentistry has been as productive as he was, either in Germany or in any other country, and this applies less to the quantity of his published work than to its many sidedness and its scientific value. It must be admitted that the soil which he found was fertile, and actually invited scientific cultivation. In many respects, there were lack of clearness and unscientific conceptions: so many fields lay fallow, untouched by the spade of science. Bacteriology had already celebrated great triumphs, but it had touched very lightly the domain of dentistry. And what a field was here offered to the research worker, a field of constantly growing importance, the ground of which fulfilled all conditions for the propagation of bacteria. But it needed, to continue the simile, the experienced farmer, who knew the soil and was able to manipulate the spade.

Miller possessed the qualities without which a successful elaboration of the material was inconceivable. Equipped with a sound preparatory schooling in natural sciences, endowed with energy and perseverance to an unusual degree, he obtained the foundation of an able bacteriologist under Koch's tuition. Much of his work published in the first years of his professorship concerned the bacteriology of the mouth. His studies on dental caries were used as the basis of one of his two main publications, "The Micro-Organisms of the Human Mouth," which made his name known far beyond

Fig. 1.—Scientific laboratory of original Dental Institute in Berlin. It is interesting to see in what a small laboratory Miller produced such great results.

the limits of his special field, and in the realm of general medical literature. In this work, Miller proved the importance of bacteria of the mouth in relation to both local and general disease, and also put the pathology of dental caries on a scientific basis.

The investigations into the question of immunity, to which Miller devoted himself in the last years of his life, are an extension of this field of work. The first paper dealing with this subject appeared in the year 1903 under the title "Introduction to the Study of the Question of the Relative Immunity of the Mouth Tissues Against Parasitical Influences," and it was followed by several others. With these researches, he had entered the domain of physiologic chemistry, and it can be predicted with some certainty that this was the commencement of investigations which must be taken up sooner or later by competent scholars. Too little attention has been paid the important bearing of the semiology of the saliva in diagnosis in pathology.

The "Handbook of Operative Dentistry" is a second comprehensive work, several editions of which have been published. In this, Miller gives the experience gained in the course of his professional and teaching activities, and the reception accorded the work is proof enough that it stands high in the estimation of both students and practitioners.

The number of single scientific publications is astonishingly great. I have succeeded in tracing 164, and this number does not include those with practically identical contents that have appeared in foreign periodicals and books. Many of these separate contributions were, notwithstanding their comparative brevity, the result of intensive experiments carried over a long period; which indicates their great scientific worth. Furthermore, these articles are not restricted to one domain. Many deal with the practical phases of the profession and with theoretical scientific questions.

Fig. 2.—Auditorium of the original Dental Institute in which Miller had his lectures.

Milled lived in two hemispheres, and he became as well known in America and England as in Germany, for a great part of his literary work was also published in

American periodicals. He often traveled abroad, and although the journeys were primarily for recreation, they mostly had scientific aims. This applies particularly to his visits to the United States and to London. He frequently visited his friend J. Howard Mummery, in London.

Miller's special field was experimental research, his salient characteristics being thoroughness and tenacity of purpose in working out appointed problems. It was of the greatest interest to those around him to watch individual experiments being conducted, often for years and in the most ingenious manner, in order to test processes in the cavity of the mouth experimentally with the help of artificial imitations of the natural conditions.

Miller's uncurbable eagerness to widen his knowledge in every direction was one of his characteristics. He never ceased learning or collecting experience in new fields, even when they had no connection with his special subject. If new problems interested him, he studied their rudiments, visited clinics and laboratories, and equipped himself with all that seemed to him to be necessary for the successful elaboration of the subject in question.

He was always attracted by problems in natural science, for it was their study that determined the course of his scientific development, and he succeeded in applying his knowledge with great sagacity in this general domain to the solution of similar questions in his special field of research.

The manner in which Miller utilized time is exemplary. It was only through close personal intercourse that one got to know what he was able to do in a day, and diversified as were the matters with which he was occupied, he had the capacity of devoting himself to all with equal concentration. He even found time for physical exercise. He was well known on the Berlin golf course, being a master of the game, and holding the championship for Germany for several years.

If Miller was honored in an unusual degree, this was due not alone to his scientific activity, but also, at least to an equal extent, to his unwearying furtherance of the interests of the dental profession and of endeavors to raise the latter in its social position and in its scientific and practical efficiency. For years, he persisted in his efforts to elevate the conditions of the study of dentistry.

The great influence that he exerted in the professional societies enabled him to strengthen all existing forces in the membership, as is instanced in the Central Association of German Dentists, of which he was president for six years. It may be permitted me to repeat here the words that I used in addressing a large gathering of professional colleagues in December, 1905, when the question of an attempt to prevent Miller's intended resignation of his professorial post in Germany was under discussion:

> Although I know that the competent higher authorities themselves are fully aware of the importance of Professor Miller in German dental surgery as a scientific investigator and university teacher, and will consequently, and without our interference, bring the great weight of their influence to bear on the man whose merits stand so high, it may be regarded as being almost a natural manifestation when the whole dental profession endeavors to find means to avert the loss that threatens it.
>
> The Central Association of German Dentists must, of all dental organizations, be most seriously affected by the announcement of the projected resignation of its president. This association, whose members in every part of Germany and even beyond the country's frontiers, number almost one third of all German dentists, and probably equal the membership of all German local associations, is justified in being the first to give expression to the

feelings produced by the threatened loss of its leader. Having been in existence for forty years, the Central Association had not attained a membership of 200 five years ago. Today, its members number almost 700, and such a rapid growth is rarely recorded in the annals of professional associations. It is to Dr. Miller, to his qualities as an investigator, as a teacher, and, not last of all, as a man that this unusual progress is due.

Dental science has advanced during the past few decades in profoundness and at a speed which has hardly been equaled by any other calling. This, of course, means the collaboration of forces with the same tendencies and the same aims, but how much personal and exemplary instigation emanated from Dr. Miller, the president of the Central Association! There is no need for me to dwell on the scientific importance of Professor Miller, or to point to the recognition of this not only in Germany, but also in the whole dental world, by both dentists and physicians. I would only emphasize the high degree of objectivity and good judgment that pervades his work, and the evidences in it of the manner in which every statement has been weighed and considered from all points of view. Also, I would like to emphasize the relentless industry, the consistent determination and thoroughness that he applied to the working out of scientific problems. In all of this, Miller is a shining example. But the encouraging influences of his restless activity was not restricted to the Central Association. With a readiness that never failed, he spared neither work nor time when there was a question of complying with requests from different parts of Germany and even from abroad to impart his knowledge to dentists or to assist them with his advice. Miller is a university teacher, but all German dentists are his pupils.

The Central Association has, more than any other body, been in a position to esteem highly the qualities of its president as a personality, as a man. With his energy in representing and furthering the interests of the Association, Miller combined a modesty of character and such a great capacity for exerting a calming and adjusting influence that serious differences have hardly ever arisen among the hundreds of members, and whenever such threatened, no one knew better than he how to smooth the waves.

The Central Association, as the intellectual center of dental science in Germany, has also to acknowledge with gratitude and respect the fact that, as a member of the university body, Professor Miller, by birth a foreigner, has always and everywhere upheld in the first place the interests of dentistry in Germany. In our eyes, he has become a German.

The work done by Miller for the Central Association of German Dentists, outside his professional activity, would in itself have been excessive for any ordinary man; for, apart from other obligations that he fulfilled, he personally replied to as many as 1,300 letters in a single year. But it was not so for him: he accomplished much more. He was also elected president of the Fédération Dentaire Internationale, a body with an extensive organization comprising all civilized countries.

When the community at large had to be served, Miller stood in the first place, and he found confidence everywhere. He was president of the Union of Teachers of Dental Surgery of the German Universities, president of the committee for dental postgraduate courses in Prussia and president of the benevolent fund for German dentists. In no case was there any lack of his activity. Where advice or help was necessary, when an authoritative judgment was requested by the individual, or by the authorities, Miller was always among the first to be sought. This self-sacrificing readiness to help was, moreover, not limited to the professional sphere. For nineteen years, he had been a member of the administrative council of the Young Men's Christian Associa-

tion, and when, early in its development, it became desirable to acquire a plot of land in the Wilhelm Strasse on which the association could build a home of its own, it was Miller who seconded the high-minded Count Andreas Bernstorff in standing security with his fortune. Although the rapid development of the association soon placed it on a sound financial basis, Miller's action was a courageous one.

Considering the closeness of the relations that Miller maintained with the American colony in Berlin, it was natural that a man possessing his qualities should become the center and a firm mainstay of its interests. For twelve years, for example, he was treasurer of the American Church, an office that could not be administered without much trouble and self sacrifice, and what he meant to the church may be judged from the words of the pastor, who, when Miller was leaving, said: "If you go, the church goes."

To all these qualities are still to be added the quite personal, human traits, those of the heart and of the soul, and all this makes comprehensible the universal affection and esteem that Miller enjoyed. Warm hearted in all his intercourse, animated with the most kindly feelings toward those in need and toward those who sought his council and help, forebearing with the weaknesses of others, scrupulous, often too scrupulous, in his endeavor to wound nobody, ever tormenting himself with the thought that he might have done wrong to someone, he won all hearts. As a helper of the poor, he spared himself no trouble to give effective aid, and not seldom he visited poverty in the attics, to make sure that there was real need, and that the family deserved assistance. His wife shared his views and attitude in these matters, and was his constant second. Many a tear was dried unknown to the outside world. Very few know of the presents given regularly every year under the Christmas tree in the quiet of the home, where practical Christianity reigned.

That there were at times disappointments, that generosity was abused, was inevitable, but Miller was never discouraged.

The Millers' family life was the happiest that can be conceived. Everything breathed peace and calmn, and the most complete harmony. His wife, herself equipped with the best womanly virtues, taking an interest in everything that concerned Miller internally and externally, even bore an active part in his scientific work. Three fine children completed the family circle. The harmony in the household was a source of invigoration for mind and body. In this family happiness, Miller accomplished everything. Without it, he would never have become the man that we knew, and when we hold up Miller's life to honor, we will not forget the share that his wife had in it.

His house was a hospitable one. The quiet brightness of the atmosphere that pervaded it was simple and natural. Miller himself was finely humorous. He took an interest in everything and he found pleasure in the small things of life. Social gatherings in his house were long remembered. How unforgettable were the evenings for the assistants in the college, which he arranged once in every semester. There was nothing in him of the pedant. He participated whole-heartedly in harmless play, and he was foremost among the youngest in standing on his hands or his head.

To his assistants, Miller was a kindly superior, a paternal friend and adviser. Participating in their interests and objectives, he was always ready to further each one's advancement, to help him with word and deed. He assisted many an

indigent student, and every petitioner who manifested the will and the intention to succeed was sure of his sympathy and support. Grateful remembrance will be the memorial to this man in many hearts.

There was, of course, no lack of outward honors, and what could be bestowed as a visible mark of appreciation fell richly to Miller's share. Though he was pleased with such recognition, it never effaced the characteristic modesty of his nature.

As a lasting memorial in grateful recognition of what Miller did for the development of dentistry, the German dentists established a fund, the successful formation of which was communicated to Miller a few days before his departure from Germany, in an address which runs as follows:

Hochverehrter Herr Geheimrat!

The last months of your presence in Germany, during which you have been so often the object of the most cordial ovations on the part of the German dentists, will have convinced you that your many years of activity in Berlin have been of supreme importance and value for our science and our practice. You know how unwillingly the German dentists see you depart, but the hope that in your native country you will still be united with us by the bonds of friendship and by common work is a consolation to us when we think of the space that separates us.

Festivities and words are transient, and all that remains is recollection, which barely outlives a generation. The two greatest organizations of German dentists wish that the grateful memory of your activity shall remain alive, and with this purpose in view, they have created the

MILLER FOUNDATION

The undersigned Committee hands over to you, Herr Geheimrat, this document, which shows that the fund was established today with the starting sum of 6,832 marks. The foundation, with your name, therefore, will keep awake the grateful remembrance in which the German dental profession holds you, and it will, with its revenues, operate in the manner that you would wish.

Miller was also honored by the establishment of the International Miller Medal, which is awarded at intervals of several years for the best scientific work in dental surgery in all countries.

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SCIENTIFIC PROGRESS OF THE LAST CENTURY IN ORAL SURGERY, ANESTHESIA AND RADIOLOGY*

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WHEN we think in terms of time and the hundreds of thousands of years that have preceded this one, a single century is a comparatively small unit. Yet how much can occur in the span of one hundred years! As we turn back the pages of dental and medical history a single century, we find that not one of the subjects, oral surgery, anesthesia or radiology, existed in 1833. In fact, the terms themselves were unheard of in those days.

As the progress of oral surgery, anesthesia and radiology are so clearly linked, I shall discuss a century's progress of the

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three subjects as a group rather than give a separate discussion of each.

In the absence of both anesthesia and radiology, oral surgery never could have progressed to the point where it stands today, an honored and distinct specialty of dentistry. Although surgical operations in and about the mouth and on the jaws have been performed since the days of Hippocrates, they were not operations in oral surgery, but in general surgery. May we revere such men as Ambroise Paré, Robert Wooffendale, Lemaire, John Greenwood, Horace H. Hayden, Chapin A. Harris and others who, long before the period of which I am writing, became interested in oral conditions in their medical practices and laid the foundations of what has now developed into the specialty of oral surgery.

It was not until eleven years after the beginning of the period under discussion that anesthesia was discovered. Probably no scientific contribution has ever been made which has added so much to the development of surgery as the discovery of anesthesia. It now seems to us quite incredible that although surgery had been practiced for nearly twenty-five hundred years, nothing had been found to relieve the pain from the operation until nearly the middle of the last century. The English historian, Lecky, says, "It is probable that the American inventor of the first anesthetic has done more for the true happiness of mankind than all the moral philosophers from Socrates to the present time." The history of the discovery of anesthesia is so familiar and the subject has been treated so thoroughly in the past that only a few of the important high lights will be mentioned in this discussion.

Dentistry may well be proud to claim one of its practitioners as the discoverer of anesthesia.

Always when the discovery of anesthesia is intelligently discussed, the name of Horace Wells will be spoken with reverence, for it was he who on December 11, 1844, inhaled nitrous oxide gas for the purpose of having a tooth extracted. On recovering and finding his tooth out he exclaimed excitedly, "It is the greatest discovery ever made. I did not feel it as much as the prick of a pin." That was the first tooth extracted without pain and was the birth of anesthesia.[1]

It is very interesting to note that his discovery of the anesthetic powers of nitrous oxide seems to have stimulated others of inventive minds, among them W. T. G. Morton, a former student of Wells, and Charles T. Jackson, a chemist. Jackson suggested to Wells that breathing sulphuric ether should produce the state of anesthesia, and, Sept. 20, 1846, Morton performed the first successful operation with ether. Strangely, about a year later, in November, 1847, J. Y. Simpson of Edinburgh discovered the anesthetic properties of chloroform.

It seems unusual that these agents were all known long before their anesthetic properties were discovered. Sulphuric ether was known five hundred years before it was used as an anesthetic. Nitrous oxide was discovered by Priestly in 1776—nearly seventy years before its anesthetic properties were known; and it is also interesting to recall that chloroform was discovered almost simultaneously in America, France and Germany, in 1831 and 1832, fifteen years before it was used as an anesthetic.

It was Oliver Wendell Holmes, father of ex-Chief Justice Holmes, who suggested the name for the condition of insensibility produced by these agents, and the use of this name has become universal. Dr. Holmes said, "The state should, I

1. Discovery of Anesthesia by Dr. Horace Wells. Memorial Services at the Fiftieth Anniversary, Philadelphia: Patterson & White Co., 1900, p. 42.

think, be called anesthesia—this signified insensibility. The adjective will be anesthetic. Thus, we may say 'the state of anesthesia' or 'the anesthetic state.' The means employed would be properly called 'the anesthetic agent.' "[2] Thus, the three most popular and efficient of the anesthetic agents which are the most widely used today came into existence about the same time, that is, between 1844 and 1847.

Obviously, the introduction of anesthesia gave a great impetus to surgery. Many operations could be attempted which previous to that time were thought impossible. For nearly three-quarters of a century after the discovery of general anesthesia, ether and chloroform were the anesthetics generally used in major surgical operations. In recent years, other general anesthetics have made a place for themselves, especially ethylene, sodium amytal and avertin. It is not germane to this paper to discuss the merits of or the indications for these anesthetics. Suffice it to say that they are worthy factors in the progress of anesthesia. They will probably never displace ether, but will be additions to the anesthetic agents.

We must remember that, at this time, oral surgery had not come into existence. Dentistry itself had begun its career as a distinct profession only five or six years previous to this discovery of anesthesia. At that particular time, both the dentist and the physician were led by the needs of their patients to perform operations not only within the oral cavity but also on tissues adjacent to it. Many of these men were educated neither in medicine nor in dentistry, but had ambitions to alleviate human suffering, and it is recorded that "many of them succeeded admirably in serving their patients."[3]

One of these men, Simon P. Hullihen, was undoubtedly the first man to have quite an extensive practice in oral surgery. At the same time, he conducted a large practice in dentistry. Dr. Hullihen practiced his profession in Wheeling, W. Va., from 1835 until his death in 1857. It is recorded that, during this time, he operated in about two hundred harelip cases, fifty cleft palate cases and about one hundred and fifty cases of carcinoma of the mouth and jaws, and he reconstructed ten jaws and about fifty lips. In his history of dental surgery, Koch comments on this achievement as follows: "Add these to a busy practice of a successful dentist practicing in all branches of his profession, and one can realize the great energy and usefulness of the man. Few have lived to accomplish as much in a greater number of years."[4] At this time, it seems that it was not necessary to have a degree to begin the practice of either medicine or dentistry, for Dr. Hullihen's degrees were honorary. The Medical Department of Washington College at Baltimore granted him the medical degree and the Baltimore College of Dental Surgery conferred on him the dental degree, in 1843. Dr. Hullihen's unique career of nearly a century ago was undoubtedly a great stimulus to his successors in practice to follow his example. Although history does not record the fact, it is quite probable that the brilliant achievements of Hullihen had a profound influence on the great Garretson, who came on the stage two years later and who is now recognized as the Father of Oral Surgery.

James Edmund Garretson lived between the years 1828 and 1895. He was graduated from the Medical School of the University of Pennsylvania in 1859,

2. Footnote 1, pp. 18, 19.

3. Brophy, T. W.: Evolution of Oral Surgery in Past Seventy-Five Years, D. Cosmos, 62:42-55 (Jan.) 1920.

4. Koch, C. R. E.: History of Dental Surgery, Chicago: National Art Publishing Company, 1909, p. 134.

just two years after Hullihen's death, and from the Philadelphia Dental College in 1862. From the beginning, Dr. Garretson seems to have been very much interested in teaching. Immediately after graduation, he became a member of the faculty of his Alma Mater, but before taking up his work, he resigned and accepted a professorship in the Philadelphia School of Anatomy, a position which he held for five years. While in the School of Anatomy, Dr. Garretson became interested in surgery, and this eventually led him into surgical practice, which he followed throughout his life. At this time, operations on tissues in and about the mouth were being attempted by the general surgeon and the general dentist. We must keep in mind that neither medical nor dental legislation regulating the practice of the respective professions was in operation at this time.

Through his long experience in the anatomic laboratory, Dr. Garretson saw a special field in surgery which might be improved on by special training. This field he decided to name "oral surgery," which thus became the first specialty to be evolved from dentistry. At first, it met with severe criticism and opposition on the part of those who regarded it as an unnecessary division of surgery, and at that time there was a positive prejudice on the part of medicine against any specialties. By means of his personality, coupled with his strong convictions and skill, Garretson so impressed his critics and other contemporaries that it was not long before oral surgery was made a special branch in teaching.

In 1869, Dr. Garretson was appointed oral surgeon to the hospital of the University of Pennsylvania. This was the first official recognition of oral surgery as a specialty. During that year, Garretson published the first book on oral surgery, entitled, "A Treatise on the Diseases and Surgery of the Mouth, Jaws, Face, Teeth and Associated Parts,"[5] which ran through six editions between 1869 and 1890. In the preface to the second edition, entitled, "A System of Oral Surgery,"[6] which came out in 1873, he says, "During the time of writing the book, the author has had in mind continuously the recognition of the fact that in no department of medical science has there existed a hiatus such as that found today between general surgery and dentistry—a lacking span, truly, in the bridge of practice." Continuing, he says,

> A patient with an oral disease of any complexity trusting himself to the average dentist, meets with disaster because of the absence of surgical knowledge and skill. Approaching from the side of medicine, he suffers alike from the want here of a special character of information which has hitherto been looked upon as having relation alone with a specialty. To bridge the gap by supplying the lacking span is the highest ambition of the author.

This work on oral surgery, containing nearly 1,100 pages, is very complete, and must have been a great influence in shaping the troublesome course of the new specialty. The contents of the volume and the thorough discussions would do credit to an author of more modern times. As an illustration of the fact that this great surgeon was as much interested in dentistry as he was in surgery, we find that the contents of more than 300 pages of this book are devoted to diseases and repair of the teeth, and the remainder to those subjects more closely related to surgery of the mouth and adjacent tissues.

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5. Garretson, J. E.: Treatise on Diseases and Surgery of Mouth, Jaws, Face, Teeth and Associated Parts, Philadelphia: J. B. Lippincott Co., 1869.

6. Garretson, J. E.: System of Oral Surgery, Philadelphia: J. B. Lippincott Co., 1873, pp. v, vi.

At this time, approximately 1870, efficient local anesthetics were unknown and, of course, proficiency in the administration of general anesthetics was lacking. Even then, fourteen years before Kohler introduced cocaine to the profession, some form of local anesthesia was being sought. In the second edition of his book, Garretson says, "The employment of various local agents to secure exemption from pain in the operation of extraction of teeth has of late commanded so much attention that no chapter treating of such operations would be complete without reference to the subject."[7]

He then describes the local anesthetic agents in use at that time. The application of the principles of refrigeration to the part to be operated on was recommended. It was done by inclosing in a piece of bladder pounded ice and salt and enveloping the tooth to be extracted, the bag of ice and salt being brought gradually in contact with the area to prevent pain from the cold. Concentrated tincture of aconite is described as a useful anesthetic when applied to the gums. Garretson says, "A mixture of chloroform and laudanum in equal parts is much lauded by some." This was used by laying the mixture against the tooth to be extracted.

The use of electrogalvanism, which claimed considerable attention at one time, consisted in applying one pole of a battery to the forceps while the other was held in the hand of the patient. A gentle current was then passed and the tooth extracted while the current was passing. The application of cold by the ether spray was also used at this time, for a local anesthetic. This method was revived about twenty years ago as a local anesthetic in the preparation of cavities in the teeth. At the time of which I am writing, about 1870, the hypodermic syringe was not generally used in connection with local anesthesia. Rynd of Edinburgh invented this instrument in 1845, and, in 1853, Alexander Wood improved the syringe and injected solutions of morphine to anesthetize the tissues. He thought he was getting local anesthesia when, as a matter of fact, it was probably the general effect of the drug on the system that rendered the operation painless. This method apparently did not meet with any degree of success, for it was soon abandoned.

Let us not forget for the moment that, at this time, dental education, upon which Dr. Garretson and his contemporaries were attempting to build the study of oral surgery, was really in its infancy, with but ten dental schools in existence. Hence, the development of local anesthesia in dentistry and in oral surgery was progressing rather slowly. As I have stated, Dr. Garretson's book on oral surgery ran through six editions, the last one coming out in 1895. During all of this time, it was the only treatise in existence on the subject of oral surgery. In 1897, John S. Marshall published a book on "Injuries and Surgical Diseases of the Face, Mouth and Jaws,"[8] which ran through three editions, the last one coming out in 1909. Between the works of Garretson and Marshall, Thomas L. Gilmer published a series of lectures,[9] which were given to the senior class of the Northwestern University Dental School in 1900 and which described beautifully those oral surgical conditions with which the dentist comes in contact.

To go back now for a brief discussion of the distinguished men in oral surgery

7. Footnote 6, p. 427.

8. Marshall, J. S.: Manual of Injuries and Surgical Diseases of Face, Mouth and Jaws, Philadelphia: S. S. White Dental Manufacturing Co., 1897.

9. Gilmer, T. L.: Lectures on Oral Surgery, Northwestern University Dental School, 1901.

who collaborated with and followed Garretson, there are six men who stand out among the pioneers in the specialty. They are Thomas Fillebrown, Truman W. Brophy, Matthew H. Cryer, Thomas L. Gilmer, John S. Marshall and George V. I. Brown. All of these men were untiring in their work to advance the specialty of oral surgery to a place where it would be recognized by both medicine and dentistry, and they paved the way by which others could advance the specialty in the years that were to follow.

Both Dr. Brophy and Dr. Cryer were students of Garretson, and Dr. Cryer later was his first assistant. Dr. Brophy made a contribution not only to medicine and dentistry, but to humanity as well, by his brilliant work on cleft palate and cleft lip. He laid a foundation for this work that will last for all time, and his name will go down in history as the greatest oral surgeon of the world of his day.

The progress made in the surgical treatment of cleft palate and cleft lip during the century of which I write, and particularly the latter half of the century, was greater than during all of the centuries preceding this era. Lagenbeck,[10] in 1861, advanced the idea of bridging the mucoperiosteum to close the cleft of the palate. With their modifications, these principles, which Lagenbeck brought forward nearly three-quarters of a century ago, have been the basis for the perfected technic which is used today in the operative procedure on the palate.

We are indebted to Sir William Ferguson, a Scottish physician who lived from 1808 to 1877, for a scientific appreciation of the requirements in staphylorraphy. It was he who advanced the surgical understanding of the subject with relation to the normal musculature of the palate.

Thomas Fillebrown, who practiced from 1859 to his death in 1904, was one of the earliest operators in oral surgery and one of the pioneers in cleft palate surgery. At the time that he began his career, surgical procedure in cases of cleft palate usually met with failure. His work on both the palate and the lip was a great improvement over anything previously attempted. Perhaps a large part of his success was due to the inauguration of a new method for the administration of general anesthetics. Because he recognized the fact that, up to this time, with the methods of administering anesthetic agents used in surgery, it was difficult to operate in the mouth and keep the patient under an anesthetic, he devised an apparatus to vaporize ether or chloroform by passing air through them. This vaporized air was conveyed to the patient's mouth or nose by means of a tube. The apparatus has been improved on and the principles are in general use today. The method is still spoken of as the Fillebrown or open method of administering anesthetics.

Ferguson and Fillebrown paved the way for Truman W. Brophy to continue and improve on their fine work. A great impetus was given to the operations for cleft palate by Brophy in 1885, when he introduced the operation for cleft palate which bears his name, and which he followed until his death. This operation, which consisted of approximating the maxillary bones in early infancy, involved entirely new principles in its procedure and started a new era in the work. It is recognized today by all men doing cleft palate work. Just how the approximation should be effected is the point of difference. The Brophy method, or the direct application of force, is one

10. Lagenbeck, B. R. C.: Die Uranoplastik mittelst Ablösung des mücosperiostalen Gaumenüberauges, Arch. f. klin. Chir., 2:205-286, 1862.

way; the other, in which the approximation of the maxillary processes takes place by the natural pressure of the lip and cheeks after the lip has been operated on, is the indirect application of force.

Another step forward in the early operation on infants was first suggested by Davis Colley[11] in 1894 and has recently been revived and revised by William H. G. Logan. It involves the use of a modified Lane technic to close the entire hard palate at the same time that the maxillary processes are approximated. This operation reduces the cleft to that involving only the soft palate. Probably no phase of oral surgery has made more progress during the century, particularly during the last quarter of the century, than surgery of the palate and lip. More attention has been paid to the study of the muscles of the lip and their establishment in the normal position. Great progress has been made in the postoperative care of the lip. Formerly it was thought that unless the approximating sutures were supported by some means, the lip would spread apart. For many years, the harelip pin was used. This pin extended from one cheek to the other and was wound with heavy suture material in order to pucker the lip and retain the strain. Other operators used a heavy silver wire for this purpose. Still others covered the lip with a dressing over the suture line and bound it tight to the cheek by adhesive tape. It was found that in a surface wound, repair was always more satisfactory when the wound was exposed to the air, and Logan brought forward his harelip bow, which not only removed the tension on the wound, but also left it exposed to the air. I consider the harelip bow one of the greatest advances that has been made in harelip surgery in recent years. Today, some men splint the musculature of the lip with chromic or catgut sutures, which seems to obviate the use of the harelip bow; but all are leaving the wound exposed to the air. A greater interest in phonation is being seen among the operators on the palate and a greater effort is being made to follow the operation with speech training.

Brophy was not only a brilliant operator in oral surgical conditions, but he also found time in a busy life to publish two books of great value on the subject. He published a very extensive treatise in 1915 on oral surgery[12] and one in 1923 on cleft palate and cleft lip.[13] The name of Brophy will forever be associated with the specialty of oral surgery.

Another of the pioneers in oral surgery whom I mentioned above was Matthew H. Cryer. His work on anatomy of the head was outstanding, and he probably excelled in this work as no one else in his time. His knowledge of the subject particularly fitted him for a brilliant career in this specialty, and his contributions were far-reaching in the development of oral surgery. His best known contribution to the literature was his classical work on the anatomy of the bones of the face and jaws.[14]

Thomas L. Gilmer was one of the pioneers of oral surgery contemporaneous with these men just mentioned. Dr. Gilmer's unusual personality appealed to the student of this specialty; apparently, he never had an unkind thought. Undoubtedly, his greatest contribution to the progress of oral surgery was his introduction of interdental ligation for fracture

11. Babcock, W. W.: Textbok of Surgery for Students and Physicians, Philadelphia: W. B. Saunders Co., 1928, p. 787.

12. Brophy, T. W.: Oral Surgery, Philadelphia: P. Blakiston's Son & Co., 1915.

13. Brophy, T. W.: Cleft Lip and Palate, Philadelphia: P. Blakiston's Son & Co., 1923.

14. Cryer, M. H.: Studies on Internal Anatomy of Face, Philadelphia: S. S. White Dental Manufacturing Co., 1901.

of the jaw. Previous to the introduction of this new scientific principle, the treatment of fracture of the jaw was attended by very indifferent results. Up to this time, the surgeon had depended largely on bandages and the dentist on vulcanite splints, neither of which was very successful. With the introduction of the new method of placing the teeth in normal occlusion and retaining them through interdental ligation, 90 per cent of all fractured jaws could be taken care of satisfactorily. Dr. Gilmer brought forth this new principle in 1882. It has stood the test of time and, with modification, is still satisfactorily used today. A part of Dr. Gilmer's contribution was the use of a single bar to which the teeth were ligated, so that many fractured jaws could be treated without ligating the two jaws together.

The last of these six great pioneers in oral surgery is still living, George V. I. Brown. Dr. Brown is not only a brilliant surgeon, but also a prolific writer on topics pertaining to the specialty. His greatest contribution is his book, "The Surgery of Oral Diseases and Malformations,"[15] which was first published in 1912 and ran through three editions, the last one coming out in 1918. This book is one of the standard works on oral surgery today.

I have mentioned the names of the six outstanding men who have been the pioneers in this specialty and who have paved the way for the present generation to follow. It is very doubtful whether, if we had not had the earnest achievements and contributions of these men, there would have been the specialty of oral surgery. When we look back and realize that, up to 1900, only one book on oral surgery had been published, we realize how young the specialty really is. Since 1900, more than a score of textbooks on the subject or on subjects relating to it have been published, so that the student has a much greater opportunity to obtain information than had these pioneers. Time will not permit me to dwell on the later literature nor to eulogize the many clever oral surgeons who have taken up the load where these men left off and who have carried the specialty to greater heights. Suffice it to say that these later men have entered into it with their writings, their enthusiam and their unshaken faith in this specialty, all of which will leave an indelible print on the history of dentistry.

In these later years, the development of local anesthesia has been a great factor in the development of oral surgery. As we have seen earlier in this discussion, local anesthesia was being sought for soon after the Civil War, but little progress was made until the later eighteen hundred seventies. "It was awakened into new life by the efforts of Koller, Schleigh, Robson, and others. At the Congress of Ophthalmology held in Heidelberg in 1884, Koller demonstrated the remarkable anesthetizing power of cocain."[16] It quickly sprang into general popularity. The methods of its application then were crude and, in anesthetizing the mucous membrane, many fatalities occurred on account of the toxicity of the cocaine. As yet no means had been discovered for controlling the anesthetic agent in the tissues and, when once injected, it spread throughout the blood streams, with a general toxic effect. They experimented with comparatively small doses, but found certain persons whose

15. Brown, G. V. I.: Surgery of Oral Diseases and Malformations, Their Diagnosis and Treatment, Philadelphia: Lea and Febiger, 1912.

16. Fischer, Guido: Local Anesthesia in Dentistry, third American edition (thoroughly revised by Richard H. Reithmüller), Philadelphia: Lea and Febiger, 1923, p. 22.

reactions were unfavorable even to slight amounts. While many investigators were experimenting on the dosage of cocaine, Braun was working on a different principle. He thought that if something could be found which would combine with the anesthetic agent, but would not detract from its anesthetizing power, and which would contract the blood vessels and prevent the spreading of the agent through the blood stream, not only would the anesthetic agent be safer but also its value would be enhanced. It was he who first suggested the admixture of extract of the suprarenal capsule with the anesthetic solution. All of the early investigators recognized the toxic effects of cocaine on the heart and central nervous system, and substitutes were offered from time to time such as eucaine, holocaine, tropacocaine and stovaine, but all were found to possess less anesthetizing power than cocaine.

In the investigation for a substitute for cocaine, Braun laid down the following requirements for a local anesthetic:

1. The substance must be the equal of cocaine in its anesthetizing power.
2. The substance must be less toxic than cocaine.
3. The agent must not cause the slightest irritation to the tissues.
4. The solution must be soluble in water, reasonably stable and sterilizable by simple means.
5. It must combine readily with some hemostatic agent, such as epinephrine.

Procaine hydrochloride seems to have fulfilled these requirements. It was discovered by Einhorn in 1905 and soon came into general use. It was introduced into this country about 1910 by Guido Fischer, professor at the University of Marburg. By the use of a procaine-epinephrine anesthetic solution, conduction anesthesia was made possible. This method of anesthesia was first suggested by Dr. Halstead of the Johns Hopkins University as early as 1885. Conduction anesthesia has made possible many operations about the mouth and jaws that otherwise would have been performed under a general anesthetic. The very fact that many of these operations could be performed under a local anesthetic was a stimulus for many men to take up oral surgery as a specialty. The scientific development of local anesthesia has done a great deal to create in the dentist a better understanding of the anatomy of the head.

I think that, in this discussion of the progress in local anesthesia, I should refer to the very recent work by Benedict, Clark and Freeman[17] on the hydrogen-ion content of anesthetic solutions, whereby they have found that if the p_H is above 7, not only is the anesthetic solution more effective but also its use is accompanied by less postoperative pain. They suggest that the solution should be alkaline instead of acid and also suggest the use of procaine borate, which is alkaline and has a p_H of 8.4, while procaine hydrochloride is acid and has a p_H of 5.5. While this work is of recent date, we are inclined to believe that it is a step forward in the perfection of a local anesthetic agent. Further studies and investigations on the local anesthetic agent will go far to increase their use, not only in dentistry but also in oral surgery.

Ten years previous to the discovery of procaine as an anesthetic agent, another discovery was made which has been a great asset to oral surgery. I refer to the discovery of the "x" rays by William Konrad Roentgen in 1895. Time will not permit us to discuss in detail the many steps leading to this discovery. Those who are interested in the early history of the discovery I shall refer to

17. Benedict, H. C.; Clark, S. W., and Freeman, C. W.: Studies in Local Anesthesia, J.A.D.A., 19:2087-2105 (Dec.) 1932.

a very complete treatise on the subject by the late James H. Prothero.[18] The pioneers in roentgen-ray work labored under a handicap because little was known about the danger of this particular ray. I wish to mention just one of the pioneers in this work, and with reverence. The name of C. Edmund Kells will always be associated with the early work in dentistry with the roentgen rays. Dr. Kells did true pioneering with the rays, and the effects of them, which was so little understood at that time, finally produced in him a condition which cost him his life. The roentgen rays were discovered in 1895, and in August, 1896, Dr. Kells demonstrated them before a meeting of the Southern Dental Association. This was the first dental roentgen-ray clinic ever held. Great progress has been made during the past quarter of a century, not only in the mechanism of the machine but in the technic as well. This history of progress in radiology would not be complete without mentioning the names of two men who have contributed a great deal in putting the dental roentgen rays on a scientific basis. These two men are Howard Raper, of Albuquerque, N. M., and Clarence O. Simpson, of St. Louis. During the past few years, there has been a great development in dental x-ray equipment and advantage has been taken of this feature of the progress to put forth great advances in the technical procedure, so that today the dental roentgenogram is one of the greatest factors that we have in dental diagnosis. By the use of the roentgen rays, many operations are simplified and many obscure conditions have been made known. The dangers once attendant on the use of these rays have now been reduced to the minimum as a result of the perfection of the apparatus. It is hardly germane to this paper to discuss the therapeutic value of the roentgen rays, but, during the last decade, much scientific investigation has proceeded along this line. Through the use of a refined roentgen-ray technic, the development of both local and general anesthesia and a better understanding of surgical pathology, oral surgery has kept pace, and not only with other specialties of dentistry, but also with the specialties of medicine and surgery.

During the latter part of the century which we are discussing, there have been two great influences exerted on the progress of oral surgery, anesthesia and radiology. First of these was the theory of focal infection; and second was the World War. The theory that focal infection in and about the teeth was responsible for many systemic diseases developed during the latter part of the century under discussion, or from about 1910 to the present time. While much progress has been made, many of the problems are yet unsolved. Oral surgery and oral diagnosis have taken leading rôles in this development and, as a result, the term "exodontia" was coined and has become a part of dental nomenclature. Previous to 1910, the extraction of teeth was considered to be a part of the average dental practice. During the past quarter of a century, this type of practice has become almost a specialty in itself, so that today, in the larger practices, this work is largely referred to the exodontist.

The second factor was the experience and observations obtained by dentistry in the World War. Many dentists in the service occupied the position of what the War Department designated dental oral surgeon. With this experience as a background when they returned to private practice, many continued in the specialty of oral surgery and have been instrumen-

18. Prothero, J. H.: Some Interesting Facts Concerning X-Ray, J.A.D.A., 9:755-761 (Sept.) 1922.

tal in advancing it to a higher place in health service.

In the earlier years of the development of oral surgery, there was no organization, in either dentistry or medicine, devoted to this particular specialty. Today, in addition to the Section on Oral Surgery, Exodontia and Anesthesia of the American Dental Association, there are two very active organizations devoted largely to oral surgery. One, originating in dentistry in 1918, is the American Society of Oral Surgery and Exodontia; the other, whose membership is composed largely of men who hold both the dental degree and the medical degree and who were inspired by the experiences of the World War, was formed immediately after the war and is known as the American Association of Oral and Plastic Surgeons. Both of these organizations have contributed a great deal toward the progress of the specialty.

Previous to the beginning of the last quarter of the century of which we are reporting, oral surgery was taught in the dental schools in a very indifferent manner. The chair in this department was usually held by a physician or general surgeon with little or no experience in oral surgery, and instruction was given largely by didactic courses. Today, in practically all of the Class A dental schools, the course in oral surgery has become one of the most important in the curriculum. As dental education has advanced, and as a greater knowledge of the relationship of mouth infection to general systemic disease has been obtained, it has been found necessary for the dental student to have some hospital experience. To this end, all of the better dental schools have definite hospital connections through the department of oral surgery, whereby the dental student comes in contact with hospitalized patients. This connection has done much to bring about a closer cooperation between medicine and dentistry. Today, practically all of the larger hospitals in America are requiring as a part of their staff dental internes who work on the same basis as medical internes. The dental interne mingles with the medical internes, speaks the same language and becomes the dental diagnostician of the hospital. A greater sympathy is thus created between the younger men of the two professions. Today, the large gap which existed between medicine and dentistry is gradually closing. Both professions are discovering that they have much in common. Oral surgery has probably been one of the greatest factors in bringing about this sympathetic cooperation.

SOME OBSERVATIONS ON DIET AND DENTAL DISEASE

By R. A. FERGUSON, D.D.S.*

DIET AND DENTAL HEALTH

THE solution of the causes and the prevention of dental disease constitutes one of the most important problems confronting the medical world today. We are too prone to regard our teeth as an appendage, which may be used until painful or worn out, then discarded for artificial substitutes. The rôle dental diseases play, directly or indirectly, in systemic disease is not fully appreciated. In an article, on dental conditions among the natives of American Samoa, published in 1934,[1] I quoted Givin as follows: "The problem of dental disease might be regarded as a key problem, the solution of which would mean not only the prevention of dental disease, but of many of the diseases of digestion and nutrition that occupy such a conspicuous place in modern pathology."

Disease conditions of the oral cavity are the chief source of systemic diseases of focal infection origin. Some of the most painful and most often fatal diseases are directly traceable to conditions in the mouth. Few even remotely connect such diseases as pneumonia, tuberculosis or typhoid fever with conditions in the mouth; yet it requires but a moment of thought to realize how chronic infection of the teeth and surrounding structures, over a period of time, may so lower the natural resistance as to markedly increase the susceptibility to any disease.

I agree with Percy R. Howe, of Harvard, in his statement that sound teeth usually accompany sound bodies. It might be well to call attention to the permanent character of dental diseases. In most diseases of the body, nature attempts to restore to normal; but not so in dental diseases, all of which are permanently destructive, there being no reparation.

The acid-bacterial theory as to the cause of dental caries has practically been discarded by many of the research workers of the medical world for the more rational and generally accepted theory of "nutritional deficiencies." Dental caries may be classed as a local expression of constitutional disturbance originating in nutritional deficiency. The prevalence of the disease in the mouth is in direct ratio to the degree of civilization, the use of the so-called modern foods and, to a lesser extent, climatic conditions.

In speaking of dental conditions among Asiatic laborers in the Straits Settlements, Givin[1] again reminds us that "this insidious onset of dental disease in the Asiatic would appear to be the first pathologic evidence of Western influence." We may say that, as a rule, the more congested and highly industrialized the population, the more prevalent the disease.

Primitive peoples are practically free

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1. Ferguson, R. A.: Dental Survey of School Children of American Samoa, J.A.D.A., 21:534-549 (March) 1934.

from tooth trouble until they make contact with civilization. The American Indian was not troubled to any extent by dental caries, and it was exceedingly rare among the Eskimos before the introduction of "civilized foods." The South Sea Islander is remarkably free from tooth decay when he confines himself to his simple native diet. Only when he deviates from the native customs and diet does he lose immunity to dental disease.

The truth of the foregoing statement is very clearly demonstrated in my article[1] referred to above. The children reported in Tables 1 and 2[1] were from families in which the father is employed by the government as an enlisted man in the Fita Fita (native) guard, the Navy, or as a civilian employe. As a result of such employment, their financial status is much higher than that of the average Samoan. Consequently, they are enabled to buy many of the necessities and even luxuries of civilization. The major portion of their food is purchased from the commissary, consisting of flour, rice, cereals, crackers, candies, syrup and canned foods of all kinds. The body is usually entirely clothed and the carrying of umbrellas is prevalent, especially among the women, who thus deprive themselves of the beneficial effect of the ultraviolet rays of the sun.

Incidently, the wearing of clothes has proved detrimental to them in another way. The annual rainfall is approximately 200 inches. Before the arrival of the white man, their dress consisted of a coating of cocoanut oil, the excessive dampness having no effect on them. Now, with modern clothing, they are continually wet and, as a consequence, suffer severely from colds, pneumonia and tuberculosis.

What effect have these changes had on dental conditions among these people? We can answer this question more impressively by comparing them with other Samoans who have not come under civilizing influences to so great an extent. The prevalence of dental caries in Samoa is limited almost exclusively to the contact points of civilization, and is in direct ratio to the degree of civilizing influences. Tables 1 and 2[1] showed 22.28 per cent and 41.00 per cent, respectively, of the children affected with tooth decay; while Table 4[1], representing findings among the children in the "jungle," dietetically unaffected by civilization, showed but 3.22 per cent as affected with carious teeth.

Because of its isolation and the simple lives led by its natives, the purity of native stock and their comparative immunity to tooth decay, American Samoa is an ideal community for the study of dental disease. The Samoan is evidently losing his immunity to dental caries and the factors in this change are far more apparent than they are in the complicated, complex communities of civilization. We commend this field to the research worker.

The greatly increased percentage of dental caries in Table 2 as compared with Table 1 is due to the fact that 33 per cent of the pupils in Table 2 were of mixed blood, the majority being of Japanese and Chinese extraction, races notoriously susceptible to tooth decay. The truth of the foregoing statement is substantiated by Okumura,[2] who says 98.3 per cent of the children just entering the elementary schools of Tokyo suffer from carious teeth. In Southern Japan, the percentage is 79.04. He quotes Masaki as having found only 7.4 per cent of the children in the South Sea Islands (under Japanese mandate) suffering from tooth

2. Okumura, Tsurukichi: Some Phases of Recent Development of Dental Hygiene in Japan, J.A.D.A., 21:1273-1885 (July) 1934.

DENTAL STATISTICS BY STATES

State	Urban	Rural	Fillings	Cavities	Extractions	Malocclusion	Defective Teeth Average	Perfect Mouths	
								Urban	Rural
Maine, New Hampshire, Vermont	24	20	282	90	76	4	10.20	0	2
Massachusetts	280	18	1,806	1,198	632	36	12.20	0	0
Rhode Island	40	2	240	152	72	8	11.00	0	0
Connecticut	146	4	1,018	494	270	14	12.54	2	0
New York	460	60	3,238	1,658	740	32	10.84	2	0
New Jersey	70	4	406	256	110	8	10.30	0	0
Pennsylvania	300	74	2,548	1,005	614	32	11.14	0	4
Delaware, Maryland, District of Columbia	74	4	406	214	126	10	9.70	0	4
Virginia	56	102	330	248	56	1	4.00	8	18
West Virginia	28	34	248	174	68	2	7.90	0	2
North Carolina	20	140	274	232	48	0	3.50	0	30
South Carolina	12	78	196	148	14	0	4.00	0	10
Georgia	50	156	350	294	64	0	3.40	0	30
Florida	10	46	125	56	22	0	3.60	0	6
Alabama	66	130	366	202	116	0	3.50	4	26
Mississippi	8	66	142	94	14	0	3.40	0	18
Louisiana	30	64	176	170	24	0	4.00	0	10

State	Urban	Rural	Fillings	Cavities	Extractions	Malocclusion	Defective Teeth Average	Perfect Mouths	
								Urban	Rural
Tennessee	38	90	194	178	40	1	3.20	4	20
Texas, Oklahoma	14	26	99	41	20	0	4.00	0	4
Arkansas	15	135	236	174	40	0	3.00	0	34
Kentucky	40	74	338	112	34	2	4.30	2	10
Ohio	262	68	1,610	1,483	383	32	10.53	4	16
Indiana	52	140	520	210	112	6	4.38	2	30
Illinois	94	46	848	394	150	12	9.25	0	8
Michigan	100	100	958	294	176	14	7.14	0	4
Wisconsin	22	16	140	82	40	4	7.00	0	2
Minnesota	40	16	382	78	80	10	9.10	0	0
Missouri	68	170	538	468	48	0	4.40	0	20
Kansas	12	72	146	154	26	0	4.00	0	24
Iowa	70	160	502	358	86	4	4.10	2	22
Nebraska	42	34	280	144	92	0	6.80	0	6
South Dakota	6	16	86	20	10	0	5.30	0	4
All Others	11	20	116	32	36	2	6.00	0	8

decay; while in Yap, of 115 children, only three were affected. Dr. Boots[2] reports that among Korean people generally, from 40 to 50 per cent suffer from dental caries, but in the mountain districts, only 30 per cent are affected. Elementary school children averaged 32 per cent; while 84 per cent of Koreans employed by white families showed carious teeth. The foregoing findings are in perfect accord with my observations in American Samoa.

Let us now consider the results of some investigations among recruits entering the United States Navy from various sections of the country. For many years, I have been interested in and collecting data on the dental condition of young recruits for the Navy. This work has been accelerated by the last eight months duty at the Naval Training Station, Naval Operating Base, Norfolk, Va. We are presenting the result of our examination of 4,602 white recruits, the majority passing through this station during the time referred to above. The states which supplied recruits for this survey were the New England group, the Middle Atlantic and Southern states and the states of the Mississippi River Basin. The Rocky Mountain and Pacific Coast states are not included as individual states for lack of sufficient numbers, but have been grouped together and designated as "all others." Certain other states have been grouped because of the small number of recruits from them. Where this has been done, an effort was made to include only those states with similar climatic and living conditions. It was necessary to assume that the recruiting officers at the various stations exercised equal care in the seclection of young recruits and that they came from the same social strata.

It might be well to remind the reader that the dental officers of the Army and Navy have a far better opportunity for studying dental conditions in the various sections of the country than the average civilian practitioner. While the civilian, in his observations, is necessarily confined to his immediate vicinity, the dental surgeon of the military services has for his field of observation the entire nation, as his patients are derived from every nook and corner of the states. Futhermore, he has the added advantage of having his patients selected for him in that they are practically of the same age, averaging 20 years, and report from homes of approximately the same social and financial standing.

It has been stated above that dental diseases are in direct ratio to the degree of civilization or, in other words, industrialization, use of the so-called modern foods and, to a certain extent, climatic conditions. This fact is clearly shown in the accompanying table. The recruits from the great farming districts of the South and West are, dentally, far superior to those from the populous and highly industrialized centers of the North and East. If we accept the theory of dietary deficiency as to the cause of tooth decay, we can readily explain the rather wide difference in the average number of defective teeth as shown by recruits from the various states. (By defective teeth is meant those with fillings or cavities and those which have been extracted, as it is assumed the primary cause for their loss was caries.) To those who know the climatic and industrial conditions of the several states, the accompanying table should prove interesting. Arkansas shows the smallest number of defective teeth, averaging three per man, and Connecticut the largest, 12.54 per man. This was rather to be expected. The natives of the southern states are almost exclusively agriculturists, spending the long summer days in the open air

and sunshine. Their diet, from a dental standpoint, is almost ideal, consisting of eggs, butter, milk, fruits and vegetables of all kinds with a reasonable amount of meat. The beneficial effect of the sun's rays must not be overlooked. Connecticut being a thoroughly industrialized and densely populated state, her people spend most of their lives indoors and subsist, to a much greater extent, on canned and patented foodstuffs, the very elements in our national diet that seem most conducive to dental ills. Among the rural recruits from Arkansas, thirty-four had perfect mouths (no fillings, cavities or extractions, and normal occlusion). Connecticut supplied only two. The mean average of defective teeth per man for the entire group of states was 6.57.

While the two states mentioned above represent the extremes, the same is true, to a lesser extent, of all the other states included in this survey, the findings depending on the occupation of the people, density of population and climatic conditions.

The reader's attention is invited to the fact that the recruits from the rural districts have fewer defective teeth than those from the cities. The table shows that, as the percentage of rural recruits increases, the percentage of defective teeth decreases. This fact is nicely illustrated by Ohio, Indiana and Illinois. These states lie alongside each other and have practically the same climatic and industrial conditions, yet there is a wide difference in the number of defective teeth. Of the 192 recruits from Indiana, only fifty-two, or one of each four, came from the city and the average defective teeth is 4.38 per man. Illinois furnished 140 men, of which two of every three came from the city, the percentage being 9.25; while Ohio, with 330 recruits, of whom three of every four came from the city, shows a percentage of 10.53 defective teeth per man.

In the New England and Middle Atlantic groups, where the percentage of defective teeth per man is the highest, the urban recruits overwhelmingly predominate; while in the South and West, where the percentage is the lowest, the rural recruits are equally predominant. The boys from the country also show a total of 372 perfect mouths against only thirty from the cities. Also, while it is not shown in the table, the recruits from the country present a slightly larger ratio of filled teeth to cavities than the boys from the cities. This was surprising and is probably due to the fact that good roads and automobiles have placed dental service within the reach of all, even those living in the remote districts.

DIET

What are the nutritional deficiencies which cause tooth decay? To answer this question, let us briefly consider the dentally important vitamins A, C and D.

Vitamin A.—This vitamin is necessary for the general growth of the body and also to reinforce the immunity of the body against infection generally. Mellanby[3] says deficiency as regards this vitamin produces hyperplasia of the subgingival epithelium, with subsequent predisposition to infection. Masaki,[2] in various experiments on animals, found that changes in the teeth and their investing tissues due to deficiency in vitamin A are of the character of osteomalacia, and, in dental tissues, disturbances of calcific deposits and dislodgment of the calcium salts from the already calcified tissues were produced. He states that the epithelial lining of the mouth, gums, tongue and nasal cavity under-

3. Mellanby, May: Medical Research Council (Special Report), Series 153.

went hyperkeratosis and, at the gingival aspect, papillomatous changes. The cells of the salivary glands underwent atrophy and necrotic changes. The epithelium lining the excretory ducts showed marked cornification. These changes may reasonably be considered precancerous. Dr. Shibota[2] attributes the deposition of calculus and pyorrhea alveolaris (periodontoclasia) to vitamin A deficiency. Hanke[4] says: "The careful studies of May Mellanby and her associates have shown that structural changes can be induced in the teeth and jaws of animals by feeding diets that are deficient in vitamins A and D."

Vitamin B.—Dr. Shiabota[2] says he could not find any changes in the dental tissues in vitamin B deficiency. From the careful perusal of the available writings of many authors, it would seem that vitamin B deficiency is of little importance in dental health.

Vitamin C.—A diet rich in vitamin C is absolutely essential to establish and maintain dental health. Apperman[5] says:

> Recent careful experimental work of Zilva and Wells in England and by Howe of Harvard has shown that vitamin C is also closely connected with tooth defects. They find the tooth is one of the first if not the first part of the body to be affected by a deficiency of vitamin C, and that the teeth may be seriously involved even when the scorbutic symptoms are so slight as to be unrecognizable clinically.

Howe[5] has shown that the teeth of scorbutic monkeys are particularly prone to decay. He has also been able to produce all the dental diseases with which the dentist comes in direct contact by feeding to monkeys diets deficient solely in vitamin C. This is the most unstable of all the vitamins. A temperature of 110 F. is sufficient to destroy it in many instances. Age and stowage affects it also. Green leafy vegetables and raw ripe fruits are the greatest source, but the vegetables should not be kept too long nor the fruit peeled as the richest stowage of the vitamin is in the protective outer covering.

Vitamin D.—From a dental standpoint, this is possibly the most important vitamin. It is the antirachitic vitamin, and since the teeth are but modified bone, any disease such as rickets or conditions that affect the osseous tissues also affect the teeth. It is a fat soluble substance, ergosterol, a derivative of cholesterol. Unfortunately, vitamin D is least widely distributed in nature, and therefore it may be more often lacking in the diet. It is absolutely necessary in normal calcium metabolism, and therefore in the calcification of the teeth. It is claimed that the addition of vitamin D to the diet prevents the formation of new carious points in the teeth, limits the spread of old ones and arrests the infective processes in carious teeth. Vitamin D aids in the most important physiologic function of absorption and deposition of calcium in the osseous tissues, thus promoting calcification of the teeth. Hess[5] believes not only that vitamin D aids absorption, but also that its main activity is exerted in the intermediary metabolic processes wherein parathyroid extract is a very necessary link in the chain of normal calcium metabolism.

Calcium and Phosphorus.—While it is not the intention to discuss all the elements entering into an ideal dental diet, I wish to mention two minerals whose importance to dental health is equal to or greater than that of the vitamins mentioned above, the inclusion of them in the diet being of supreme importance: The 97 per cent of inorganic salts found

4. Hanke, M. T.: Diet and Dental Health, University of Chicago Press.

5. Apperman, I.: Calcium Metabolism and Dental Caries, D. Cosmos, 74:841-852 (Sept.) 1932.

in enamel and the 62 per cent in dentin is made up principally of calcium phosphate. This mineral is the chief constituent of the organic salts of bone and cementum. Calcium is present normally in adult blood to the extent of from about 9 to 11 mg. per hundred cubic centimenters of blood. The percentage is lower in pregnancy owing to the drain on the maternal calcium to meet the growing demands of the fetus; hence, the necessity of increased calcium intake during pregnancy and lactation. In children, the percentage may be from 13 to 21 mg. per hundred cubic centimeters of blood. Calcium is of the greatest importance in many of the physiologic functions of the body. It diminishes the permeability of all cell membranes in the body, and therefore indirectly influences the water balance and water metabolism through its action on the permeability of the capillary walls and on the hydration capacity of colloids. It increases vascular tone and the force of cardiac muscular contraction. It is absolutely necessary in the coagulation of blood. It is necessary for the passage of nerve impulses across the neuromuscular junctions and the synapses between the nerve fibers and cells.

As stated before, calcium phosphate forms the major portion of bone and tooth structure. In the deposition of calcium in the formation of bone and teeth, the exact physiologic process in unknown. Apperman[5] says:

> One theory states that CO_2 tension is low in the osteoblasts, or bone forming cells, and therefore calcium precipitates therein. Another hypothesis discloses the presence of the enzyme, phosphatase, in the epiphysis of the bones, which acts on a hexose-monophosphate of calcium thus freeing PO_4 ions and causing the precipitation of calcium phosphate.

To maintain normal calcium metabolism in the body, a sufficient amount must be ingested daily. In the adult, 1 gm. daily is required. During pregnancy and lactation, at least 2 gm. daily is needed to protect the bones and teeth of the mother from decalcification. Infants and growing children require a relatively high amount.

Phosphorus.—Phosphorus also is an essential element in the calcification of bone and teeth, and due provision must be made for it in the diet. It is normally present in adult blood in the proportion of from 3 to 4 mg. per hundred cubic centimeters of blood and in children from 4 to 6 mg. per hundred cubic centimeters of blood. The desirable ratio of calcium to phosphorus in the diet leading to maximum absorption is about 1:1 or 1:1.5. If either mineral is present in excessive or unbalanced proportions, it unites with most of the other mineral and is not utilized but is excreted in the feces, and rickets may occur. This is particularly true in excess phosphorus intake when rickets occurs from calcium deprivation.

No attempt will be made to discuss the chemistry or food value of the various articles of diet. This has been done by many more able writers and their findings are available to all. It is my understanding that Jones, Larsen and Pritchard have, as a result of their nutritional study among Hawaiian children, concluded that the acid-base balance of the body is of paramount importance. In their work, the restoration of certain native foods supplied elements that had been lacking in the modern Hawaiian dietary, and they recommend that foods supplying a maximum of alkaline ash be taken in greater abundance by the average American family. An excess of alkali reserve has a tendency to produce atrophic pyorrhea, which doubtless explains the almost universal prevalence of this type of pyorrhea among the older adult Samoan population. I shall merely mention the several important foods which contribute

to dental health, and certain diets which other writers have used in treating dental ills. Here, let me remind you that the most enthusiastic proponent of the dietary deficiency theory as the cause of tooth decay does not expect every child to be perfect dentally whose mother, during pregnancy and lactation, received an ideal dental diet. The influence of heredity is too strong to admit of this being possible. We do submit that this is possible after several generations, provided the dietary requirements of each generation are strictly met.

SOURCE OF VITAMINS

The chief sources of the several vitamins and minerals are as follows:

Vitamin A: Found most abundantly in butter fat, egg yolk, cream cheese, cod liver oil, glandular tissues such as kidney, pancreas and liver, uncooked lettuce, cabbage, spinach, celery, carrots, whole wheat bread, many fruits, tomato juice, etc.

Vitamin B: Found in whole grain, beans, peas, fruits, lentils, nuts, green vegetables, sweetbreads, kidney, liver, etc. Important dentally only as it affects the general health.

Vitamin C: Found in apples, beets, raw cabbage and carrots, green celery, lemons, lettuce, milk (raw, summer), orange juice, peaches, pineapple, potatoes (white), spinach, tomatoes and turnips.

Vitamin D: Found in whole wheat bread, butter (summer), cream cheese, cod liver oil, eggs (summer), milk (raw, summer) and viosterol. Recently, there has been placed on the market a product known as "irradiated vitamin D milk," which is pure milk exposed to ultraviolet light. This product has been approved by the Committee on Foods of the American Medical Association and is recommended very highly for its vitamin D content. The ultraviolet rays of the sun are the activating source of vitamin D.

DIETARY REQUIREMENTS

Calcium and phosphorus requirements will be satisfied if a diet sufficiently high in caloric value is selected from the articles of food mentioned above, particularly if the diet includes, daily, one-half pound of spinach, lettuce or cabbage and one quart of milk for calcium requirements, and two eggs or one quarter pound of cream cheese; or the same amount of brains will meet the demand for phosphorus.

Hanke[4] has had some most gratifying results in treating periodontoclasia, acute ulcerative gingivitis and other gum conditions through dietary efforts alone, slight instrumentation being necessary in some cases. His efforts consisted not so much in changing the ordinary diet, but rather in adding certain elements to it. These additions consisted approximately of from 8 to 24 ounces of orange juice daily, this depending on the severity of the case, the larger amounts being reduced when the case began to respond to treatment. Usually to the foregoing was added the juice of 1 lemon, one-quarter head of lettuce, from 1 to 2 eggs, 2 cooked vegetables twice daily, 1 quart of milk and 1 pint of cream. Needless to say, the above-mentioned food items were varied to meet individual requirements. Under this treatment, obstinate cases of periodontoclasia of long standing quickly responded, exudation of pus ceased, the teeth tightened and the gums returned to normal. The general health also was improved. Hanke says: "The concept that certain foods have a specific effect that is limited to the oral tissues is undoubtedly erroneous. The easily observable reactions on the oral tissues are most probably similar to changes that are occurring in the other parts of the body." The foregoing statement, if true, is further proof that dental diseases are systemic rather than strictly local. Ad-

mittedly, in such diseases as periodontoclasia, bacteria are a potent factor while the tissues are unhealthy *(locus minoris resistentiae)*.

Merritt[6] concurs in the above-mentioned requirements in the treatment of dental diseases, also Apperman,[5] who suggests the following diet for the correction of dental diseases and the maintenance of dental health. He says,

To obtain all the essential ingredients in a diet, the daily menu should include:

(1) Cod liver oil, three to six teaspoons. (Vitamins A and D.)

(2) One pint orange juice or tomato juice or lemon juice or one-half pint raw meat juice (Vitamin C).

(3) Two eggs or one-quarter pound cheese or one quarter pound brain (phosphorus).

(4) One-half pound of spinach or lettuce or cabbage or one quart milk (calcium).

In addition, there should be one tablespoon butter a day and two or three fruits. These figures are for adults. The quantities may be halved for children. During pregnancy and lactation the diet prescribed above is increased by 25 to 50 per cent if possible. In addition, calcium lactate (xx grs t.i.d.) is given by mouth. The pregnant woman would also do well to take about one-half hour sunshine daily or, better still, about ten minutes exposure to the carbon arc or two to three minutes under the mercury vapor lamp.

Granting the cause of dental diseases to be nutritional deficiencies and accepting the foregoing articles of diet as preventive and curative agents for dental ills, we can readily understand the wide variation in the number of defective teeth as shown by the recruits from the several sections of our country.

6. Merritt, A. H.: Periodontal Diseases, New York: The Macmillan Company, 1930, p. 153.

CONCLUSIONS

Dental diseases present a major problem because of their influences on general health. Diseased teeth are the primary cause of some of the most painful as well as fatal diseases.

Dental ills seem to be an aftermath of civilization or civilizing influences.

Recruits from different sections of the United States show a wide variation in number of defective teeth, variation apparently due principally to climatic and occupational conditions, which determine the chief articles of daily diet.

The diet must be sufficient in caloric value and contain certain vitamins and minerals if dental health is to be established and maintained.

Dental health begins prenatally, and since every child has the divine right to be born in a healthy condition, the diet of the expectant mother should be carefully selected and regulated.

Gum conditions, being systemic rather than local, respond very gratifyingly under the stimulus of proper diet.

The opinions or assertions contained in this article are the private opinions or assertions of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.—Article 113, U. S. Navy Regulations, 1920.

NEED OF DENTAL CONSULTATION IN LIFE INSURANCE EXAMINATION*

By BOYD S. GARDNER, D.D.S., Rochester, Minn.

WHAT is to be gained by dental consultation in a life insurance examination? My interest in attempting to answer this question has been prompted by the excellent paper by Millard D. Gibbs[1] and the recent editorial by C. N. Johnson[2] in THE JOURNAL, and by personal experiences in undergoing medical examinations for life insurance.

To obtain first-hand information regarding the attitude of the medical directors of many well-known life insurance companies, I have addressed the chief medical examiners with the following inquiry: "When and under what conditions is a dentist consulted by your company when a medical examination is made? If dental consultation is obtained does it include an x-ray examination of the entire mouth?" The attitude of such officials toward dental consultation can best be set forth by the following excerpts from their answers:

1. I cannot remember when we have used the services of a dentist in connection with a medical examination.

It appears that this medical director does not consider dental infection an important factor in life insurance examination.

2. A dentist would not be consulted on an examination for this company unless there was some special history calling for such consultation. Such consultation would not call for an x-ray examination of the entire mouth unless the condition was such that it covered the entire mouth and the consulting dentist already had the films.

I assume that the reference to some "special history" would refer to a patient who had an oral condition that could be observed by simple inspection of the mouth, as the medical director says that an "x-ray" examination of the entire mouth would not be requested unless the condition was such that it covered the entire mouth. It does not seem that he had in mind significant conditions that might be found at the apices of individual teeth, or other foci of infection that might increase the insurance risk.

3. In reply may I say that we do not, in our routine business, require the consultation of a dentist on applicants who are presented to us. If the condition of an applicant's teeth is such, in the judgment of the examiner, as to add to the mortality on the risk, such an applicant is declined or postponed until he has had the oral condition remedied. We do not on our own initiative ask a dentist to treat an applicant, and in the meantime withhold our decision pending result of treatment.

Evidently, this physician believes it possible that certain conditions of the

*From the Section on Dental Surgery, The Mayo Clinic.

*Read at the Second General Meeting of the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

1. Gibbs, M.D.: Life Insurance and Medical Examination, J.A.D.A., 19:1851-1855 (Oct.) 1932.

2. Insurance Companies and Dental Ailments, editorial, J.A.D.A., 21:890-891 (May) 1934.

teeth would add to the risk, for he states that "such an applicant is declined or postponed until he has the oral condition remedied." He also says, "We do not on our own initiative ask dentists to treat an applicant." It seems, therefore, that this company passes to the applicant the responsibility of finding a dentist capable of remedying the oral condition to the extent that it will satisfy the medical examiner. Simple inspection of the mouth, apparently, is sufficient for him to determine whether the dental condition has been satisfactorily remedied. Instead of being guided by a dentist employed by the insurance company, it would seem that the applicant runs the risk of having inferior work done by an incompetent dentist, who may unwittingly camouflage the condition which might be considered a hazard.

4. Our instructions to the medical examiners of our company are to always examine the applicant's teeth and throat. We do not order x-ray examinations unless especially indicated.

Some encouragement is given to the dentist in that the throat and teeth are put on the same basis, although examination of both is made by the physician. Dentists will, of course, admit that a physician can report the condition of the throat by inspection, but that he can make a dental diagnosis without the use of roentgenograms seems doubtful. This medical director refers to roentgen-ray examination when "especially indicated," but he does not go into details as to what conditions would make a roentgen-ray examination necessary.

5. Our action is primarily based on the report of the examining physician as to whether or not the services of a dentist are required. Our final action is then based simply on the statement by the dentist to our examiner that adequate treatment has been instituted. In other words, we seldom if ever require specific details from the dentist beyond the point mentioned.

Here again, the need for the services of a dentist would seem to be determined by the examining physician and final action based on the statement by the dentist to the examiner. The question might be raised as to the qualifications of the dentist. The examining physician undoubtedly was well selected by the insurance company, but the applicant's dentist might be one incapable of reporting the true condition of the teeth and of their investing tissues. He adds further that specific details are seldom if ever required from the dentist beyond the point he mentions. This attitude gives little credit to the part the dentist might play in prolonging the life of the persons insured, or in making them more comfortable.

6. Our procedure is to limit our examination to that made by the examining physician. We do not refer applicants to a dentist and do not request x-ray examination of the entire mouth. We are fully appreciative of the value of such an examination, but doubt if we could incorporate it as a regular routine.

This company doubts that it could incorporate a dental examination as a routine procedure. Perhaps the cost of such an examination plays a rôle in such a decision. This particular point was brought to my attention eight or ten years ago, when I had in my office several of the officials of a well-known life insurance company. They called on me with the local agent because I had several of their policies and they wanted to get better acquainted. I was frank in stating that I was not particularly proud of the fact that I had successfully passed their medical examinations since I did not consider the examinations adequate, since at no time had the examining physician inquired concerning the condition of my teeth nor made any dental examination.

One of the officials expressed the opinion that dental examination would be desirable, but pointed out that it would be necessary to have a chief dental examiner at the home office and that the cost of maintaining such service would be prohibitive.

7. To date, we have not asked that an applicant appear before a dentist for the expert advice he could give us regarding the condition of the teeth. However, we do have a question on our medical examination blank which reads as follows: "Are the throat, mouth, tonsils and teeth in a healthy condition?"

This answer puts the throat, mouth, tonsils and teeth on the same basis and is therefore more favorable to the dentists than some of the other answers. It must be admitted that simple inspection of the mouth means something, as the color of the gums means much and, in certain tooth surfaces, caries can be detected. Without the use of the roentgenogram, important data may not be obtained.

8. I fear that you will be somewhat surprised in this answer to your letter of February 27 concerning the matter of dental consultation in connection with our medical examinations for insurance, as the company does not require dental examinations, and I do not recall any instance in which we have asked for a dentist's opinion in selecting business. . . . We ask our examiners to comment upon the condition of the mouth, the teeth and the gums, and our action on an application is influenced by unfavorable conditions which are found in that manner. We realize that many dangerous conditions of the teeth thus escape our attention as we are not unmindful of the importance of such conditions to the general health and of the relationship of the dentist to the medical profession.

This answer is very frank in that this physician states that he does not recall any instance in which a dentist's opinion was asked in selecting business. The medical director realizes that many dangerous conditions of the teeth do escape attention and states that the company is not unmindful of the importance of such conditions to general health. This attitude holds out the hope that eventually the company will require dental examinations.

9. I feel that my answers to your questions will be of little help, as they are of a negative nature. We do not at the present time ask for a dental examination. I think there is a tendency to make the insurance examination more comprehensive than heretofore, particularly when large lines of insurance are involved, but the special emphasis in recent years has been in the direction of more elaborate examinations of the heart, such as the electrocardiogram and the x-ray. The whole matter should perhaps be given more consideration than we have hitherto given it, and I shall be much interested in receiving a reprint of your paper.

This answer implies that progress has been made in insurance examinations when electrocardiograms and roentgen-ray examinations of the heart are required. This would indicate the fact that more effort is being put forth to determine the condition of the applicant, but whether the main interest of such companies in requiring a more thorough physical examination lies in the immediate acceptance of the applicant or in taking preventive measures to insure the future health of the policy holder is not quite clear. Perhaps more of the large companies will see the advantage in keeping their policy holders well.

10. I daresay the time will come when the opinion of a dentist who has made an x-ray examination of the entire mouth will be sought; at present, however, such a procedure would delay matters and in many places a valuable opinion might be difficult to obtain.

This answer implies that, in the future,

the opinion of a dentist will be sought. Why this director says that a valuable dental opinion might be difficult to obtain is not altogether obvious. Perhaps he is not aware that there is an ample supply of qualified dentists to act as dental consultants in life insurance examination.

11. When our examiner reports the teeth to be foul and needing extensive repair, it is our custom to postpone the application until this work is successfully completed. In these cases there is very often a reflection of his pyorrhea in his general condition, particularly in his blood pressure or digestive tract, which would cause this postponement. If a dental consultation is desired, we naturally would insist on an x-ray examination of the entire mouth.

This answer is so different that special attention should be given it. This director evidently has observed that there is a connection between the general and dental condition of the applicant and this acknowledgment should lend encouragement. It perhaps would have been better had he been more explicit and had he referred to pyorrhea as really being a symptom of what is going on elsewhere in the body. He might also have applied the same line of thought to caries. It is encouraging to note his statement that if a dental consultation is desired, he naturally would insist on roentgen-ray examination of the entire mouth.

12. We never employ the services of a dentist when considering an application for new insurance. Occasionally, when considering claims for total disability benefits in which there is a suspicion of foci of infection in the mouth, we have x-ray examinations of the teeth and nasal accessory sinuses, but usually this type of work is done by physicians specializing in roentgenology.

It is the practice of the company to offer a health conservation service to certain of its policy holders, in which we have examinations made by our appointed doctors in various localities. Whenever an examiner finds evidence of or suspects dental defects of any type, it is our custom to call these defects to the attention of the policy holder and to urge him to consult his personal dentist. This letter, and I am afraid letters you may receive from other companies which will be similar, indicates our need of education along the lines of your proposed paper. When reprints are ready for distribution, I would appreciate it very much if you would send me one.

This reply is distinctly hopeful, as it is the first in which the phrase "foci of infection" has been used, but the director is not altogether complimentary to the dentist in stating that when roentgen-ray examinations of the teeth have been required by his company, a physician specializing in roentgenology is consulted. The reply is encouraging also in that reference is made to what can be accomplished by continuing to keep the insured person informed concerning life extension. This medical director gives further encouragement by admitting the need of education in this field.

13. I think it fair to state that, in the average life insurance examination, but little attention is paid to the condition of the teeth. In general, it is only the marked cases of pyorrhea and of caries which attract the attention of the medical director. In such instances, it is the procedure, in this company, to postpone the application until the teeth have had adequate care and treatment by a dentist. . . . It is our custom to rely upon the evidence given by the examiner as to the presence of these conditions. We practically never refer an applicant to a dentist for his professional opinion for x-ray examination. In other words, we rarely ask for a dental consultation.

The condition of the teeth of the insurance public is undoubtedly better today than it was fifty years ago, which may, in part, explain the present-day improvement in mortality. It is my opinion that detailed

examination of the teeth, in the absence of the gross diseases indicated previously, is not necessary in the average insurance case. For that reason, we do not make a detailed examination.

You will note that I have stressed, in the foregoing paragraphs, the average cases. In the case of individuals applying for large amounts of insurance, I should consider any company justified in more rigid attention to the condition of the teeth of the applicants. In these cases, in the presence of evidence of extensive dentistry, of crowns, and of possible loss of vitality, I should consider a complete x-ray examination of the mouth as entirely justified on the part of the medical director. However, I cannot recall our having requested such an examination, under such circumstances. As a rule, the individuals who today are applying for considerable amounts of insurance appreciate full well the value of their teeth, have the money to take care of them, and actually devote a sufficient amount of time to careful treatment and prophylaxis.

This medical director refers to marked cases of pyorrhea and caries, and such reference is of considerable interest to dentists. His statement that applications are postponed until the teeth have had adequate care and treatment by a dentist is significant. This director also distinguishes between the average applicant and the applicant who applies for large amounts of insurance, and it seems logical to give the applicant who is taking out large sums of insurance a more rigid examination than one taking out an average amount. On the other hand, it might be pointed out that rigid examinations diminish the risk in average cases as well.

From the foregoing, it appears that some medical directors are not wholly conscious of the rôle that focal infection plays in certain diseases, of the recognition that dentistry received during the World War and of the important part it has played in public health work, especially in our public schools.

On first thought, one might be prompted to criticize the stand taken by insurance companies regarding dentistry in general. On second thought, one might do better by comparing the present attitude of the insurance companies with the lack of interest shown by public school authorities twenty years ago. The school authorities did not seek dental service, but certain dentists undertook to educate these authorities to the need of dental examination. It seems, therefore, that our insurance problem is one of education.

In the dental examination of school children, a vital spot was hit in that the taxpayer found that when more children were kept in health, the cost of education was less. It was found that to require a child to repeat a grade added to the expense and that ill-health played a leading rôle in such repetition. Thus, the cost of medical and dental management in our public schools has been more than offset by the reduction in the cost of public school education.

Whether it is entirely true or not, the average person carrying life insurance believes that the more thorough the medical examination, the cheaper will be the cost, as the applicant unfit for life insurance would be more likely to be found and rejected. So, from an economic standpoint, there appears to be something in common between the school dentist who already exists and the life-insurance dentist that we hope to create. Under the present system, the respect for medical examination may be lessened in many instances, since holders of life insurance are likely to use as a measuring stick the medical examination given them by the company physician at the time that they make application for insurance. In other words, one may be accepted for life in-

surance and undergo medical examination for the first time. From the congratulations received from the agent who wrote the policy and congratulations by letter from the home office, the policy holder is made to feel proud of the fact that he is physically fit. Afterwards, he may seek other medical advice and find that the examination made by the insurance physician was not altogether adequate. The more thorough examination may have revealed dental infection as well as infection elsewhere in the body, and it might be the applicant's first intimation that caries and pyorrhea were present, to which no reference was made at the time of his examination for insurance.

I do not wish to infer that no progress has been made in medical examination for insurance, for more comprehensive questions are being asked and more data are being registered. Moreover, certain companies have found it beneficial to follow up their policy holders by sending out health information, and one company in particular has seen fit to stress the dental phase. This type of publicity tends to greater confidence in life insurance companies, for their 63,000,000 policy holders are no doubt keenly interested in adding more and comfortable years to their lives. I use this word "comfortable" to stress what can be accomplished by the dentist, not only from the standpoint of prevention and elimination of oral infection, but also from the standpoint of his ability to restore lost teeth, making it possible for his patient to masticate food and improve his personal appearance.

It is true that many insurance blanks contain the question: "What is the condition of the teeth?" But if the physician merely repeats the question to the applicant, the answer almost invariably will be "good" or "satisfactory," and it will be so recorded by the examining physician. Even when the physician makes a visual examination of the oral cavity, little is accomplished, and modern dentists place no reliance on such examination. It is unnecessary to enumerate the different steps in making a complete dental examination. Certainly, one of the important procedures is the adequate use of the roentgen-rays.

Certain life insurance companies take the stand that if dental consultation were included in life insurance examination, the cost would be prohibitive. It is true that the dentist would expect a fee approximately equal to that of the medical examiner, but this additional cost could scarcely be considered excessive. At all events, as I have previously suggested, the resulting improvement in selection of applicants should diminish, rather than increase, the net cost of insurance to the policy holder.

Many group insurance policies as well as other individual policies are written without medical examination. The answers to the questions are filled in by the agent, and constitute what may be called a medical examination which compares favorably with the answers filled in by the physician, with the exception that with the usual forms of insurance, the physician actually makes a physical examination, recording blood pressure, the condition of the heart and lungs, etc. Moreover, it is understood that many groups have made application for reinsurance and have been rejected because there was not a sufficient percentage of members in health to make the policy worth while to the company.

Gibbs[1] states:

> Insurance companies are called benefactors of humanity and rightly so, but how much more far-reaching they would be in that particular were they to go into health investigations thoroughly. Had the applicant for life insurance who was accepted

been carefully examined dentally, he might have been warned of approaching danger by the dentist and conditions corrected; which would have made him a far better risk.

Gibbs emphasized another important point: that the more thorough the examination and the more interest shown by the insurance company in follow-up, the larger would be the percentage that would be able to take additional insurance. So by lenience in insurance examination, it seems that a hardship is often imposed on the policy holder and that less revenue accrues to the company.

It is obvious that the word "prevention" should not be applied to dental infection alone, as the elimination of infection elsewhere is of equal importance. Moreover, reference should not be made to dental infection from the standpoint of focal infection alone, as it is well recognized that dental infection, like infection elsewhere, can constitute a physical load or drag.

Thus far, I have attempted to bring out benefits to the policy holder, as well as to suggest, at least in one respect, that the insurance companies themselves would benefit. I may add that if dentists receive recognition by insurance companies, the relationship of medicine and dentistry will be strengthened, since it will be necessary for insurance companies to employ dentists not only at the home office, but also in the field where insurance is written.

Opposition to dental examination is to be expected from insurance agents, for this examination will become another barrier to the issuance of insurance policies. The time required for dental management would constitute only a temporary delay. Moreover, the examination would react very much in favor of the policy holder, since he would benefit from a standpoint of health and, in addition, might be aided by the dentist in correcting dental defects that might act as a handicap to personal appearance. Such management would arouse in the policy holder more genuine respect for the company and for the policy which has been issued to him.

The information that could be disseminated by dentists through insurance avenues would result in policy holders becoming more interested in dental health. They could be instructed as to how dental infection can best be prevented and how missing teeth can be replaced. The dental examiners could inform the policy holders that management of pyorrhea and caries from the standpoint of prevention is far more economical than an attempt to manage these two diseases once they have progressed, especially if a point is reached where extraction is necessary. The successful management of pyorrhea and decay, like that of disease elsewhere in the body, depends on early recognition.

Medical and dental directors could work hand in hand in their follow-up effort to safeguard the health of the policy holders and, by their efforts, would accomplish more if the policy holder's physical examination included a thorough examination of the teeth by a competent dentist.

In presenting these facts and opinions, I realize that much effort has already been put forth by individual dentists in calling the attention of the insurance officials to the desirability of dental examination. If dentistry ever is recognized by insurance companies, as every dentist hopes that it will be, that recognition will be secured only by the combined efforts of the dental profession in giving expression to their ideas at dental meetings and in taking advantage of every opportunity to bring the necessary knowledge directly to the insurance companies themselves.

RELATION OF CERTAIN ACIDURIC BACTERIA AND CERTAIN FOOD ELEMENTS TO DENTAL CARIES*

By DON C. LYONS, M.S., D.D.S., Ph.D., Jackson, Mich.

GREAT stimulation was given to research into the causes of dental decay by the discovery that this condition is one of our major health problems in that defective teeth frequently act as foci of infections; for with the discovery and use of the roentgen-rays, it was revealed that there were often hidden sources of infection at the apices of decayed teeth.

Detailed discussion of the history of this health problem will not be entered into here because it has been so amply covered in various other papers and texts. May it suffice to say that, with the discovery of the relationship between disease and bacterial growth by Pasteur and with the promulgation of the bacterial theory of dental decay by Miller in 1884,[1] the present era of research in this field began.

INTRODUCTION TO PROBLEM

In presenting the results of this investigation into the causes of dental decay, I wish to state that I am fully aware of the fact that the rat, in the words of Holt, "is not a human being and probably never will be." It is felt, however, that the albino rats which are used throughout this study are admirable laboratory animals to use in an endeavor to ascertain if possible the answers to certain questions about the bacterial flora of the oral cavity. It is therefore believed that the albino rat should be looked on in this connection in accordance with the recent statement of Sherman,[2] who says, "I think it scientifically accurate to state, as the conclusion indicated by the great mass of evidence now existing, that what we find for the rat is within the probabilities as applied to the human."

There is little investigation into the diseases affecting the human being which can be applied directly to human beings, other than by the mathematical formulas derived for the laws of probabilities owing to the length of time needed and lack of controls necessary to produce well-substantiated findings. The results presented here are specifically applied to the albino rat. If a correlation can be made between these findings and those made in the case of the human being, it should be done. I deliberately refrain from entering into any discussion as to the relative anatomic values of rat molars and human teeth. Dental literature contains many references to the subject without reaching any agreement.

*From the Bacteriology Department of the Michigan State College, East Lansing.

*An abstract of the thesis presented to the Graduate School of the Michigan State College as part of the requirements for the degree of doctor of philosophy.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

1. Miller, W. D.: Microorganisms of Human Mouth, Philadelphia: S. S. White Dental Mfg. Co., 1890.

2. Sherman, H. C.: Oral Hygiene, 24:518 (April) 1934.

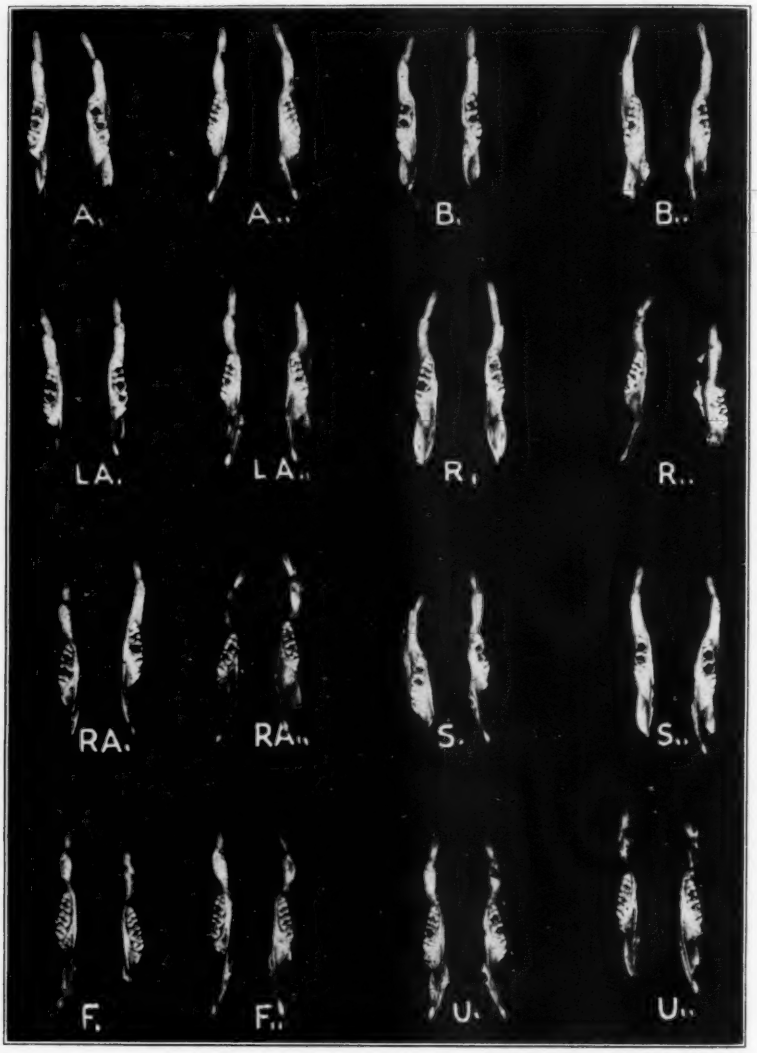

Fig. 1.—Rat jaws from Experiment 2, Group 1; showing carious teeth which developed during eight weeks experimental period.

A study of the voluminous literature now existing in published form reveals that there are two outstanding theories as to the cause of dental decay: that which considers the local environmental conditions as the cause, and that which

considers defective nourishment as an instigating factor. Attempts to correlate the two have consistently met with difficulties.

In general, it is admitted that the bacteriochemical theory of dental decay is fundamentally sound. Investigations have, in the past few years, pointed to the fact that *Lactobacillus acidophilus* is a predominating organism. A critical survey of the literature reveals that this organism does not seem to be present in all cases of dental decay. Fish recently[3] came to the conclusion that *Streptococcus mutans,* which he found in many decayed areas, was the instigating factor. Enright[4] and his co-workers found fifteen varieties of bacteria in decayed teeth. They found also that there was a little difference in the incidence of *L. acidophilus* between individuals with active decay and those free from decay. They recovered *L. acidophilus* from the mouths of 61 per cent of their group who had active decay and from 52 per cent of those who were free from decay.

Rosebury[5] says, "Thus far we have not been able to satisfy ourselves that lactobacilli alone among bacteria are capable of decalcifying enamel *in vivo* or that any critical p_H level of enamel solubility exists."

Enright[6] and his co-workers suggest that perhaps the natural association of the lactobacillus with *L. buccalis, Neissaria flava,* and *N. perflava* might be conducive to caries.

The general conclusion is that the active agents of caries are oral microorganisms which produce and can withstand an acid of high concentration.

3. Fish, E. W.: D. Surgeon, 29:271 (May 14) 1932.

4. Enright, J. J., and Friesell, H. E.: J.A.D.A., 20:897 (May) 1933.

5. Rosebury, T.: Disc. Enright et al., Footnote 6, first reference.

6. Enright, J. J.; Friesell, H. E., and Trescher, M. O.: J. D. Res., 12:759 (Oct.) 1932. Footnote 4.

OBJECT OF STUDY

The object of this study is to ascertain what relationship, if any, exists between aciduric bacteria, certain food elements and dental decay. Hoppert, Webber and Canniff[7] and Devereux and Etchells[8] have been able to demonstrate that if rats are fed a diet which is adequate in every respect, but the corn or rice used in the diet is rather coarsely ground, dental decay will result. On the other hand, if the rice or corn is finely ground, decay does not develop. This has injected a new question into the problem of dental decay, that of the importance of food impaction. At first, it was thought that there was no decay when the food was finely ground because there was no impaction. This supposition was later shown to be false. There is impaction, but the food is so firmly packed in that it is now believed that it forms an almost impervious coating in the dental grooves. One must remember that this impacted food is still fermentable. Why, then, granted the presence of aciduric bacteria, doesn't decay develop? Further, if it is necessary for the saliva to reach every surface of the tooth in order to prevent decay, as is suggested by several investigators, why is there no decay when this fermentable food is packed into a cavity so tightly that the saliva cannot permeate it? These questions remain unanswered.

In this investigation, a number of common acid-producing carbohydrate-fermenting organisms were used. Albino rats of known health and parentage were

7. Hoppert, C. H.; Webber, P. A., and Canniff, T. L.: J. D. Res., 12:161 (Feb.) 1932.

8. Etchells, J. H., and Devereaux, E. D.: Proc. Soc. Exper. Biol. & Med., 30:1042 (May) 1933.

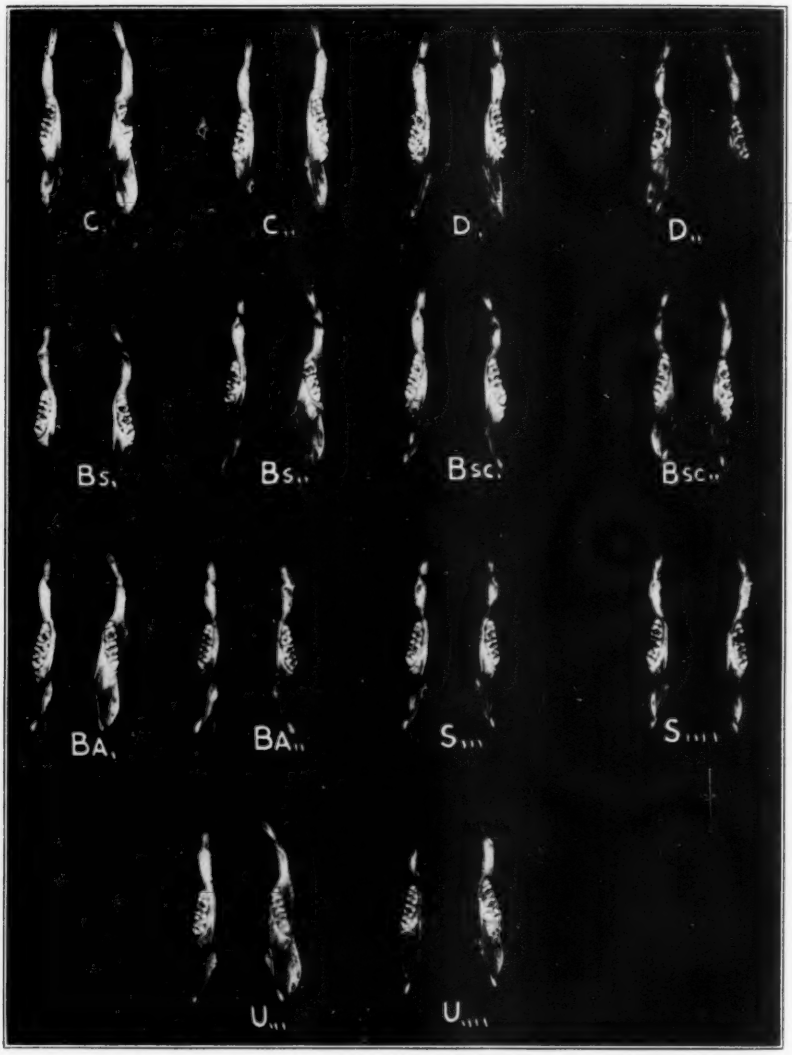

Fig. 2.—Rat jaws from Experiment 2, Group 2; showing carious teeth which developed during period of this experiment.

used in the experiments, their teeth being caries-free, and all gaining weight at a normal rate. Nomenclature as applied to the bacteria used in the experiments is that accepted by the American Society of Bacteriologists.

METHODS USED

The experiments herewith reported consist of three types of study; (1) a study of cultures obtained from decayed areas in human teeth, (2) a study of the results obtained from different cultures placed in the food of the albino rat, and the bacteria flora obtained from their mouths and (3) a study of the relationship between the certain vitamin deficiencies produced in the albino rat and dental decay.

Experiment 1.—In the first study, cultures were obtained from the teeth of approximately 500 persons. These cultures were obtained from three locations: (1) the mucous membranes and gum tissue surfaces, (2) the outer portion of the decayed tooth and (3) that decayed portion of the teeth last removed before restoration. The specimens were obtained by the use of either a chrome steel or a platinum needle, which was flamed and then applied to the area in question. The pabulum or débris picked up was then washed into a small test tube (Wassermann size) which contained 1 c.c. of sterilized 0.6 per cent saline solution.

After the débris had been dispersed throughout the solution by vigorous shakings, it was streaked on either or both plates of yeast extract-agar or blood-agar of a p_H of 6.8. A loop of the same material was also placed in a test tube containing 20 c.c. of sterilized yeast extract broth. The medium used was made according to the accompanying formulas.

Yeast Extract Broth

Yeast extract (dehydrated)		5 gm.
Peptonized milk		10 gm.
Salt		5 gm.
Dextrose		10 gm.
Distilled water	q.s.ad	1,000 c.c.

Adjust to a p_H of 6.8 and autoclave for 15 minutes at 15 pounds.

Yeast Extract Agar

Same as broth with addition of 15 gm. of agar.

Blood-agar according to standard formula.

Examinations were made at frequent intervals to determine the character of the growth and to identify the cultures obtained. Fermentation tubes of the various sugars were run in all cases to determine acid or gas production and the results were further checked by the use of litmus milk mediums.

The patients studied were divided into six groups according to age, as a survey of the literature failed to show that much attention has been paid to the bacterial flora of the mouth according to age groups. Group A included patients from 1 to 10 years; B, 10 to 20; C, 20 to 30; D, 30 to 40; E, 40 to 50, and F all who were 51 or older. Only those persons having active dental decay were studied. An effort was made especially to determine the *L. acidophilus* distribution. According to the cultures recovered from the carious teeth, it was as follows: A, 84 per cent; B, 66; C, 49; D, 20; E, 14, and F, 2.

It was further noted that as the individual age increased, there was a definite change in the type of bacteria found in the carious teeth. In the D, E and F groups, flagellated bacilli and streptococci predominated. Both these organisms produced acid in fermentation tubes, and acid and coagulum in litmus milk mediums. The streptococcus recovered was usually from 0.6 to 0.8 microns long, occurring in pairs, tetrads or short chains, gram-positive greenish or hemolytic on blood-agar. It made broth turbid, coagulated, made litmus milk mediums acid and was a facultative aerobe.

Cultures obtained from the gum tissue surface and surface pabulum of the carious teeth were generally mixed of yeast forms, fungi, flagellated bacilli, spirochetes and cocci. *L. acidophilus* was seldom recovered in such cultures, but this may of course be due to the fact that there was an overwhelming growth of

the other bacteria in the cultures. No attempt was made to classify the bacteria recovered because only *L. acidophilus* was being studied at this point.

Experiment 2.—In the second study, seventy-four albino rats were used. These rats were obtained from two sources: the biology department stock colony and the dairy department stock colony of the Michigan State College. The two groups were fed on the same stock rations before the beginning of the experiments; namely,

Cornmeal	60 per cent
Whole milk powder	30 per cent
Oil meal	6 per cent
Alfalfa leaf meal	3 per cent
Sodium chloride	1 per cent

This was adopted as the stock colony ration after considerable experimentation and has proved adequate in every respect for growth, reproduction, lactation and general health.

Group 1: Sixteen albino rats were divided into eight groups of two rats each. These rats were placed in individual sterilized wire cages and individual compartments which did not communicate with each other. The cage bottoms were made of large mesh screening; which did much to keep the cages clean.

A basal ration was prepared consisting of the following items, which had proved adequate in other experiments as a complete rat food:

Rice	63 per cent
Oil meal	15 per cent
Alfalfa leaf meal	10 per cent
Dried yeast	5 per cent
Casein	5 per cent
Sodium chloride	1 per cent
Calcium chloride	1 per cent

The rice was ground until 52 per cent passed through a No. 20 screen, 47 per cent through a No. 40 and 0.05 per cent through a No. 60. The remaining 0.05 per cent was classified as dust. Three thousand gram lots of this food were prepared at a time and then 50 gm. of the ration placed in individual galvanized iron feeding cups. These were then plugged with cotton and autoclaved for fifteen minutes at 15 pounds pressure. The procedure was repeated whenever the food cups became empty or at least every four days. The food was repeatedly checked for sterility after autoclaving, remaining sterile for at least a month, the longest test period.

The sixteen rats in Experiment 2, Group 1, were divided into eight divisions of two rats each. A 10 c.c. portion of a 48-hour broth culture was stirred into the 50 gm. of food with a sterile glass rod. The following cultures were used:

SBR-A: Two rats. *L. aciaophilus* isolated from human teeth of the A group of Experiment 1.

SBR-B: Two rats. *L. acidophilus* isolated from human teeth of the B group of Experiment 1.

SBR-La: Two rats. *L. acidophilus*, stock colony.

SBR-R: Two rats. *B. ramosus*, stock colony.

SBR-RA: Two rats. *B. ramosus* and *L. acidophilus* A, equal amounts of each.

SBR-S: Two rats. Sterilized basal ration.

SBR-U: Two rats. Unsterile basal ration.

SBR-F: Two rats. Unsterile basal ration; rice ground so that it passed through a No. 60 screen.

Simultaneously with this experiment, another group, (Group 2) of rats were placed on the following cultures:

SBR-C: Two rats. *L. acidophilus* from group C of Experiment 1.

SBR-D: Two rats. *L. acidophilus*, isolated from the D group of Experiment 1.

SBR-Ba: Two rats. *Acetobacter aceti*, stock colony.

SBR-BS: Two rats. *B. subtilis*, stock colony.

SBR-BSC: Two rats. *B. subtilis* and *L. acidophilus* C.

SBR-U: Two rats. Unsterile ration.

The two experiments were continued for a period of eight weeks, at which time the rats were etherized and cultures made from the teeth and gum tissues.

After etherization, the outer surface of the mouth was sterilized by flaming. The mouth was then opened and a swab culture made of the mucous membrane.

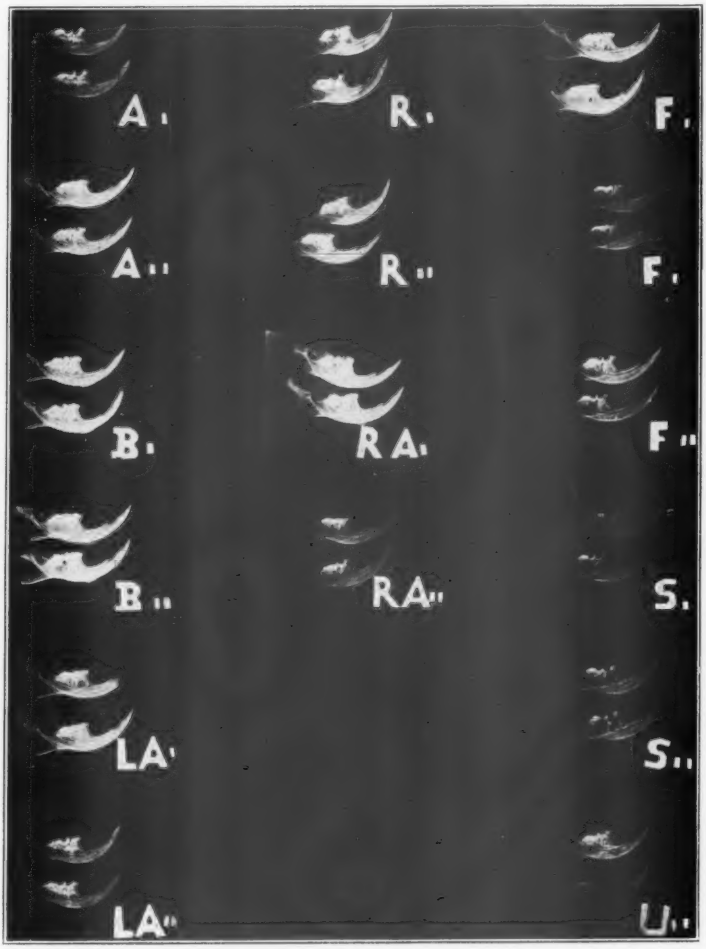

Fig. 3.—Jaws in Experiment 2, Group 1; showing extent of dental decay, location of caries and abscess formation at apices of roots.

These rats were obtained from the biology department stock colony.

The jaws were removed and held in sterile cotton, and cultures made from

the impacted food débris and carious areas. Dental decay developed in every instance in both groups of this experiment. Three rats of the first group were etherized at the end of six weeks owing to an intestinal disorder which caused abdominal distention. These were rats SBR-A2, SBR-B2, and SBR-LA2.

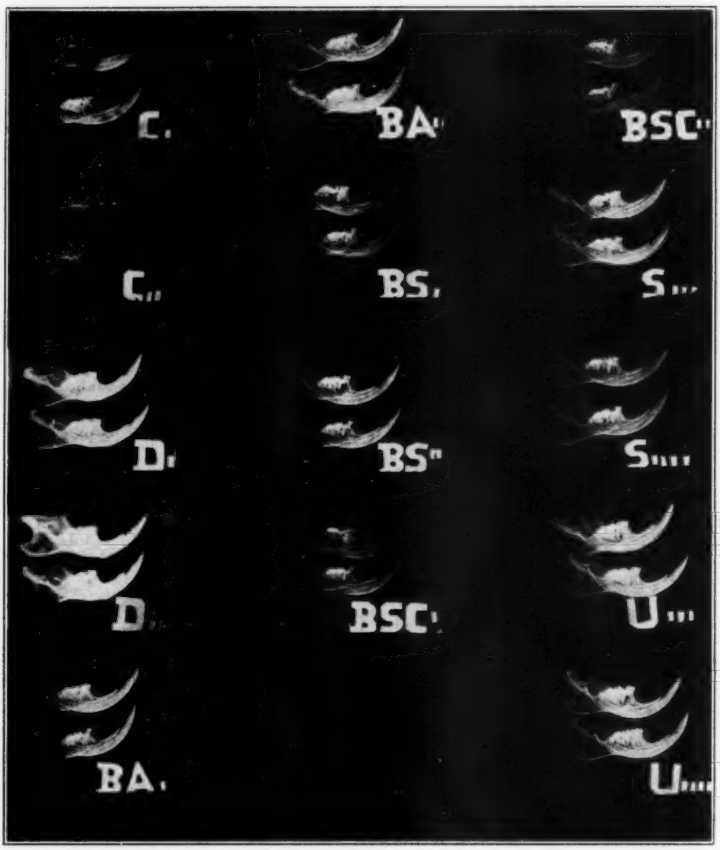

Fig. 4.—Jaws of rats in Experiment 2, Group 2; showing extent of decay, location and periapical involvement.

It was possible to recover the organisms obtained from impacted food and the carious areas in every case. In rats SBR-S and U, an organism was recovered from the carious areas which, after various tests, proved to be *Cellumonas deciduosa.* This same organism and a streptococcus which was not further identified were invariably recovered from swabbings of the mucous membranes. A test made of the oral flora of ten stock rats showed that these were

the predominating organisms in their mouths. It was therefore concluded that this was a naturally occurring organism in the mouths of this particular colony of rats.

Experiment 3.—Another group of experiments were also carried out, using rats from two sources: the dairy stock colony and the biology department colony. Sixteen albino rats were used in each group, their food being inoculated as follows:

SBR-A: Two rats. *L. acidophilus* recovered from the mouths of the A group rats in the first experiment.

SBR-Ce: Four rats. *Cellumonas deciduosa* recovered from the mouths of the rats in the S and U groups in the first experiment.

SBR-M: Four rats. A mixture of equal parts of *P. vulgaris, Streptococcus lacticus, B. coli* and *B. subtilis* were added.

SBR-S: Four rats. Sterile basal ration.

SBR-U: Two rats. Unsterile ration.

The albino rats obtained from the dairy department stock colony were exceptionally healthy. Their average weight at the beginning of the experiment was about 66.0 gm. Their average increase in the eight weeks was 120.0 gm., as shown in the accompanying table. Four rats of this group showed less gain than the others. These were the M group rats.

INCREASE IN WEIGHT OF ALBINO RATS DURING EXPERIMENT

No.	Sex	Weight at Beginning Gm.	Weight at End Gm.
M 1.	F.	66.0	154.0
M 2.	F.	61.0	156.9
M 3.	M.	68.0	155.0
M 4.	M.	65.0	156.0
A 4.	M.	79.0	216.0
Ce3.	F.	60.0	180.0
S 6.	F.	66.0	186.0
U 5.	M.	60.0	181.0

The failure to gain as much as the other rats of this particular group is attributed to the putrefactive organisms placed in the food, which cause the development of intestinal disorders. Evidence of the results of this contamination of food was noted in the rather loosely formed, black, sticky feces of these four rats. It is of further interest to note that while in Ce, S and U groups of this series decay developed, there was none in the A and M groups. It was further assumed that the lack of dental decay in the M group of rats was due to the predominance of putrefactive bacteria in the food, which overwhelmed the aciduric. The failure to find decay in the A animals seems rather at variance with the previous results, but it is believed due to the use of an attenuated culture in this experiment.

The original A culture was obtained about a year previous to its use in Experiment 3. It was attenuated by growth in litmus milk mediums until thoroughly oxidized before transference. During the year's time, it was transferred about thirty times, each time decreasing its virulence for lack of a more favorable medium.

Biology department animals were used in the second part of the experiment in order to check the growth with the previous groups, and also as a control on the development of dental decay in Experiment 2. The results obtained in this group were similar to those obtained in the first section. Again, with the use of the attenuated *Lactobacillus acidophilus* culture, there was no decay in the teeth of the A group rats. Also, no decay developed in this second M group. A check of the weights of these M animals showed that they gained an average of 30 gm. less in the eight weeks period than the other animals of the series.

Experiment 4.—In an effort to determine whether there is any relationship between certain vitamin deficient diets and the production of dental caries in the albino rat, the teeth and jaws of

fifty-five white rats were examined. These rats were on various diets, some deficient in vitamins and others containing a sufficient quantity to maintain growth and health. No attempt was made to ascertain the presence or absence of aciduric bacteria, this experiment being concerned mainly with determination of the incidence of dental decay in the teeth of rats which had been depleted of their vitamin supply and the possibility of producing a group of rats with defective teeth from a structural standpoint.

The vitamin A group contained seventeen white rats averaging in weight about 60 gm. when the experiment was started. These rats were fed the following basal diet:

Irradiated corn starch	67 per cent
"A" free casein	18 per cent
Dried yeast	10 per cent
Salt (mixture No. 1000)	4 per cent
Sodium chloride	1 per cent

At the end of a depletion period, usually from four to five weeks, or until increase in weight ceased, these rats were given various supplements. One rat was continued on the basal diet without a supplement until definite signs of vitamin A deficiency appeared. Three rats were given 0.5, 1 and 1.5 gm. of margerine daily. Four were given 2, 3, 4 and 5 gm. of cabbage, respectively. Three received one-half unit of a commercial carotene preparation daily, two received 1 unit, and two, 1½ units. One rat received 1 drop of cod liver oil daily, and one was given 2 drops. The seven rats on the carotene preparation developed the various symptoms of vitamin A deficiency and did not live over four weeks after the beginning of the experiment.

Fifteen rats were placed on vitamin B deficient diets for a depletion period of two weeks. The following diet was used as basal:

Starch	53 per cent
"B" free casein	18 per cent
Autoclaved yeast	15 per cent
Butter fat	8 per cent
McCollum salt mixture	4 per cent
Cod liver oil	2 per cent

At the end of the depletion period, the animals were placed on various diets; some deficient in vitamin B, while others contained enough to prevent the typical polyneuritis. Two rats were given Rowena feed in 0.5 and 1.0 gm. doses; two were given similar amounts of Ralston cereal, and ten were given 1.5 gm. of corn silage, plus the following amounts of whole yellow corn daily: four on the 1.5 gm., three on the 2.5 and three on the 0.5 amounts. One was kept as a negative control. The experiment was continued for eight weeks.

Six rats were placed on a diet deficient in D for a depletion period of eighteen days, the following diet being used:

Yellow corn	76 per cent
Wheat gluten	20 per cent
Calcium carbonate	3 per cent
Sodium chloride	1 per cent

After the depletion period they were given various levels of cocomalt, salmon, etc. After a period of five days, they were etherized and the line test made for healing.

Four rats were placed on the following vitamin G deficient diet for a depletion period of three weeks, or until growth ceased:

Starch	51 per cent
Whole wheat	20 per cent
"B" and "G" free casein	15 per cent
Butter fat	8 per cent
Salt mixture	4 per cent
Cod liver oil	2 per cent

One was kept on this diet without supplement; one received 1.8 gm. of dried liver daily; one received 0.4 gm. autoclaved yeast, and one, 0.5 gm. daily. The experiment was carried out for a period of seven weeks.

Thirteen rats were placed on miscel-

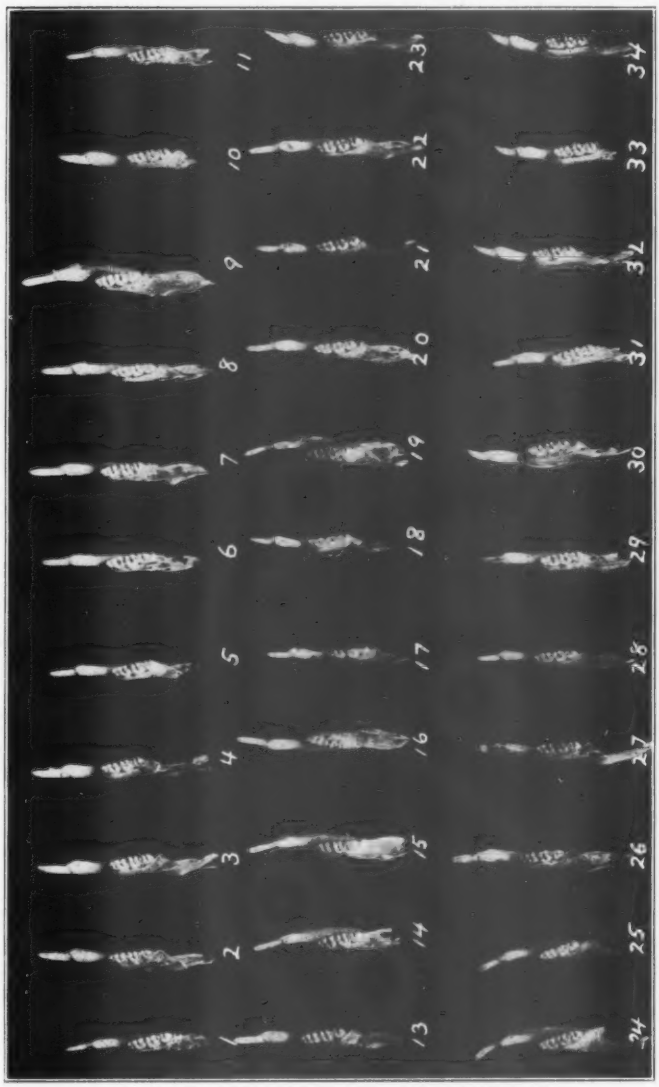

Fig. 5.—Jaws of rats in Experiment 3. *1-13*, vitamin A deficiency rats (*4-7*, controls); *14-28*, vitamin B deficiency rats (*14-15*, controls); *29-34*, vitamin D deficiency rats (*33-34*, controls).

laneous diets consisting of: fox-chow, cake and water, coffee and whole wheat bread, whole grain cereal, white bread, meat, milk powder, potatoes and lettuce.

Each of the foregoing diets was given *ad libitum* for a period of eight weeks. At the end of the various experimental periods mentioned, or when the rats died before the end of a particular experiment, as happened in several instances, the jaws of the rats were removed, cleaned and bleached.

The following results were observed:

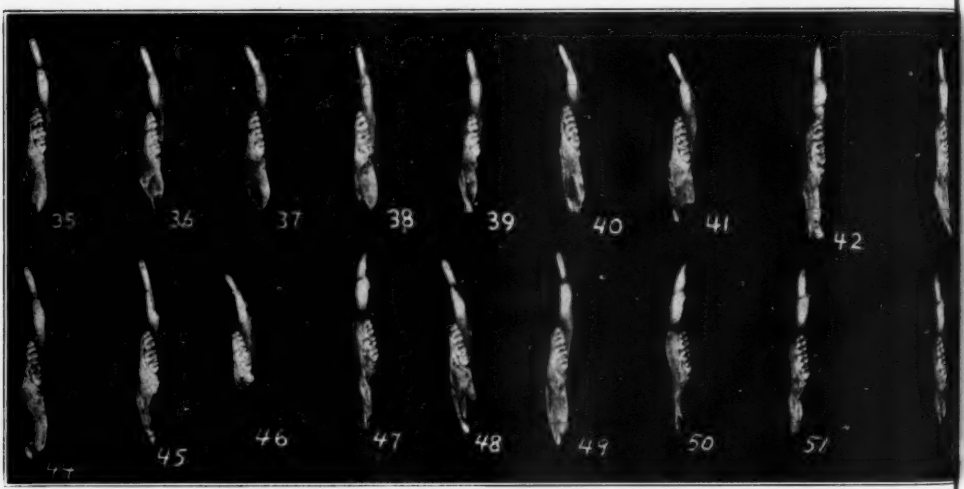

Fig. 6.—Jaws of rats in Experiment 3. *35-38,* **vitamin G deficiency rats (***35-36,* **controls); *39-52,* rats on miscellaneous deficient diets.**

In none of the rat jaws examined was there any decay. In the teeth of one of the rats on a vitamin D deficient diet (the negative control), there were two pinhole carious spots. The teeth of the rats receiving fox-chow were slightly abraded. The rats on the vitamin A deficient diet showed definite deficiency in growth of the jaw bones, but not of the teeth.

The results of this experiment were therefore considered negative, and the efforts to secure rats with teeth of poor structural development for use in the bacterial experiments, a failure. An effort is now being made to feed the pregnant rat a diet deficient enough in vitamins and mineral salts to cause defective tooth structure in the litter, but at the same time not produce sufficient disturbance of lactation to cause the death of the young.

COMMENT

In summarizing the results of these experiments, I do not present any conclusions because I feel that these observations need further investigation. It seems that the following points are worthy of emphasis:

The attempt to produce defective teeth or carious teeth in the molars of the rat after these teeth are fully erupted was a failure, substantiating the observations of others that the vitamins have little if any effect on the teeth after eruption and calcification.

It is believed that the observations on the incidence of *Lactobacillus acidophilus* in the mouths of individuals of various age groups may offer an explanation as to some of the variations in results reported by other investigators. While there may be some objection to these findings on the basis that the medium used had a p_H of 6.8 or was approximately neutral, it is believed that such a medium offers a more natural representation of normal mouth conditions than one of a p_H of 5.0, which is used by some, and gives a truer picture of the actual mouth flora. The use of a yeast extract medium should counterbalance any disadvantage to the growth factors of the lactobacillus as compared to other bacteria, because it is such a satisfactory medium for growth of aciduric organisms.

The experiments with the albino rat seem to suggest several possibilities; namely, that a number of acid-producing organisms may be instrumental in causing dental decay, among which *Cellulomonas deciduosa* seems to be the most common naturally occurring aciduric organism found in the oral cavity of the colony of rats used. Where the food of the rat was sterilized and grossly contaminated with an attenuated culture of *Lactobacillus acidophilus*, no dental decay occurred. No definite explanation has been reached as to why such a result happened.

It is thought that in each instance wherein the inoculated organism was recovered instead of some naturally occurring one, the excess of culture placed in the food acted in an antibiotic manner to the naturally occurring ones.

The foregoing observations lead to the suggestion that the antibiotic relationships of the oral flora are important factors in causing or in preventing dental decay. The results obtained with the M group rats demonstrated that it is possible for putrefactive and proteolytic organisms to overgrow or produce products antibiotic to the acid organisms. This is not a new idea. It was first demonstrated by Garre in 1887[9] and has been enlarged on since by many bacteriologists. Every question which has been raised regarding the bacterial theory of dental decay can be answered by such a theory or relationship. It warrants further and intensive study.

1405 National Bank of Jackson.

9. Garre, C.: Centrbl. Bakt., 2:312, 1887.

DENTAL MEDICINE*

By U. GARFIELD RICKERT, D.D.S., Ann Arbor, Mich.

ABOUT fifteen years ago, a member of our profession who was also a pharmacist came to me with the criticism that we teachers of dental materia medica and therapeutics were attempting to teach the use of altogether too many drugs. I asked him how many he thought were essential to dental practice, and he said not over five or six were really needed as dentistry was generally being practiced. These drugs were morphine, oil of cloves, either cocaine or procaine, phenol, formocresol and tincture of iodine. Until recently, many practitioners have criticized the large number

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 7, 1934.

of drugs use of which was being taught in the dental schools.

Of course, even as late as fifteen years ago, few of us could have agreed that our dental students should know so little of the subject of materia medica, for we were already desirous of greater cooperation with the medical profession, which would necessitate sufficient training in this subject at least to be able to speak its language intelligently as regards the major drugs, even though the dentist seldom uses them. A physician could hardly respect the degree of doctor of dental surgery of those members of the dental profession who knew nothing of the use of such major drugs as digitalis, strychnine, atropine and epinephrine. Neither could the dentist even at that time practice his art with any degree of refinement.

While my critic did not materially alter my views, he did give me food for thought by indicating the need for a better balanced analysis of the actions of the more important drugs used in medicine, with special reference to those used in dentistry.

With a view to training the dental student to a closer differentiation of drugs of somewhat similar action, I used to give an entire examination on a hypothetical case which gave me a fair idea of what the student knew of the medical properties, action and uses of drugs as applied to dentistry. It ran somewhat like this:

Suppose you were to be transported by torpedo to another planet with conditions quite identical to those here, populated with human beings to whom dentistry was unknown. All equipment we have here was to be available there, save drugs. Only one of these could be taken along. What drug would you select for demonstration purposes of the value of dentistry, if only one could be used? Now, we will suppose that, at the end of the year, all the drug had been used and you returned to this planet for more, at which time you were permitted to take two drugs. What ones would you select? Would the one you used the first year be included this time? If I were to make the selection, I would say no. Now suppose you were permitted to return the third time with three drugs. What ones would you select? Would you include any of the former ones? If I were making the selection, there is one in B position that would now remain as long as I carried drugs. So it continues for four, five, six, seven and eight years, at each time with the privilege of making an entirely new selection, but one more drug being added. What ones would be eliminated and what new ones added, for a greater and greater refinement in dental therapeutics by means of the increasing number of drugs available?

Taking the pyramid on page 427 and letting each letter designate a drug and the year the number of drugs permissible, gave us a fine hour's examination. The student was required to give the reasons for his selection in each case and what he expected to do with each drug.

Now from the experience that I have had with postgraduate groups of dentists, I became convinced that the practicing dentist might profit by taking such an inventory of his own methods. I will welcome the filling in of this pyramid and the reasons for the choice made from any one interested in the subject. I am especially insistent that the two who are to lead in the discussion here fill in the pyramid for our immediate use. Their selection should be particularly interesting, in view of the fact that one of the discussers, Dr. Gordon, is not a practicing dentist, but is probably one of the best informed persons on existing dental materia medica and therapeutics. The other, Dr. Blayney, is the author of the latest textbook on the subject. So again I urge that my readers take the time to work out this problem and mail it to me. Your answers will be kept in confidence, if you so desire, but most assuredly there will in your

replies be food for thought from which we may improve our teaching of the subject, giving it the most practical application.

You will observe that I have intentionally refrained from presenting my own views at this time, in order not to influence you in your answers. It was necessary to abandon this procedure as an annual method of examination, since the examination questions are traditionally given to one class by the former one. The students soon learned my selection and prattled this off instead of doing their own thinking. If sufficient interest is exhibited in the subject at some future date, I shall coordinate the various views with my own.

After a recent sectional meeting on the subject of materia medica and therapeutics in the American Association of Dental Schools, I learned from a questionnaire that even the teachers were not agreed as to the number of drugs that dentists should be familiar with. Their answers ranged from thirty to well over one hundred, the general average being somewhere between seventy-five and eighty. It should be enlightening to note here that the Bureau of Chemistry and the Council of Therapeutics have already examined about 1,300 drugs and preparations of dental interest. I will be very much interested in the general practitioner's views relative to the number essential.

My personal selection has been changed considerably during the past five years, just as the selection of the better practitioners must have changed. To illustrate: The rapid progress in the field for a number of years was so remarkable that no one had the courage to write a text on the subject, everyone believing that the changes were so notable that before the work could be printed, much of it would become obsolete. It was only during the past year that an author, Dr. Blayney, had the courage to present a text which in general is a conservative discussion of the subject. This text, supplemented by Accepted Dental Remedies, has given us a creditable outline for teaching purposes.

This rapid progress may be attributed to several conditions. As long as dentistry was nothing more than a mechanical art, there was little need for drug therapeusis, and such as existed was empiric. With the projection of the focal infection problem into practice, there was a closer relation to medicine and a broader knowledge of pharmacology became imminent. With this expansion of dental practice, dentistry became more and more interested in oral pathology in addition to the immediate diseases of the tooth structure itself. Finally, the establishment of the Bureau of Chemistry and the Council on Dental Therapeutics by the American Dental Association aimed at cooperating with the teachers of the subject with renewed interest.

For several years, leading teachers have believed that the service and the status of the dentist as a professional man would be much improved if he became interested in increasing his knowledge of pharmacology, materia medica and therapeutics and if he learned to write intelligent prescriptions. It is gratifying to observe that, in increasing numbers, dentists have asked for the inclusion of this subject in postgraduate courses given at the University of Michigan. They are also including discussions of the subject in their regular programs—evidence, indeed, that many practicing dentists are aware of their limitations and the possibilities in this field.

The practitioner should no longer listen to the sales talk of representatives from the pharmaceutic houses of all shades engaged in the preparation of proprietary medicines. In self-respect, he should make his own selection, both for greater

refinement of practice and for economic reasons. No operator who takes the word of salesmen as to the merits of a secret prescription is treating his patients justly today. He owes it to his patients to know what he prescribes. Unscientific mixtures sold under fancy names, usually at a cost three to eleven times greater than their actual value, seldom have therapeutic advantages equal to the simple prescription of the major ingredients. For a practitioner of today to listen to the high pressure salesmanship of representatives of many pharmaceutic houses is equivalent to bankers' offering advice as expert opinion, when, in fact, they were merely selling securities on the recommendation of a high pressure salesman of investment firms. In both cases, the purchaser is the victim of misplaced confidence. Patients are already questioning the intelligence of practitioners engaged in passing out proprietary products, just as they are now suspicious of the banker attempting to unload securities on them at the advice of investment brokers.

The broader field of operation and the increased educational advantages have made it necessary that every practicing dentist modernize his therapeutics. He should know how to write prescriptions. This procedure has been very much simplified by the almost universal acceptance of the metric system, which not only permits greater refinement and exactness, but is also of such simplicity that serious mistakes become less likely. This system not only permits of the Latin endings of the drugs used for those who prefer it, but also, if the writer prefers, the prescription may be written in plain English. Few professional men are sufficiently well trained in Latin to write the Latin endings correctly. Some of the earlier prescription writers now appear to have used greater intelligence in their use of Latin than in the contents prescribed.

The need for mystery and the patient's not knowing what is being prescribed has largely passed out, especially as far as dental prescriptions are concerned; and so today there is no reason that any professional man should hand out form prescriptions prepared by manufacturers of proprietary dental medicines. If the dentist wants to prescribe these drugs, he should write his own prescriptions and, at least, know what he is prescribing. He should be familiar with the fact that the proprietary medicines may give vague formulas, and even, at times, an exact percentage of a certain important ingredient, but that these, as obtained on the open market, may vary greatly when analyzed. I have in mind a highly advertised proprietary medicine, said by its sponsors to contain a large percentage of camphor, but samples of which, when analyzed, showed a content of camphor reduced to a point far below what the manufacturer claimed for it. Perhaps the cost of camphor entered into this, but if the dentist wants to recommend such a mixture, he should prescribe it. The following illustrate simple prescriptions such as any dentist can write:

Patient's name..... Date.....
Address.....
℞ Chloral hydrate
Potassium bromide
Syrup lemon
Water q.s. fl$_{3}$ ss.
M. Sig.: One teaspoonful in glass of water before retiring. Repeat in one hour if necessary.

This prescription was taken from the book "Dental Pharmacology and Therapeutics" by J. R. Blayney.

Name of Patient..... Date.....
Address.....

℞	Gm. or C.c.
Potassii iodid.	50
Aqua destill.	50
M.	
Sig: 5 drops three times daily in milk.	

We should be able to write prescriptions for hypnotics, general anodynes, sedatives and both stock mouth washes and dentifrices that may readily be modified with special medicaments prescribed for specific conditions of oral disease and solutions for local anesthetics. Even though we are using stock anesthetic solutions, we should know how to write a prescription for these, because it gives us more discrimination as to what the solutions should be. The dentist may require a noninjurious stock mouth wash that will do all that any one could wish for promiscuous use and contains little more than a pleasingly flavored solution. We use these in our spray bottles in our offices. Many patients wish to use them daily for hygienic purposes, but certain types of oral infections under treatment by the dentist may make it desirable that he prescribe, for temporary use only, a modified mouth wash in which mild oxidizing agents or other specific antiseptics or astringents may be introduced. Then too, there are many other drugs with varying medical properties that the dentist might desire to add to this stock solution. The same thing may be true of dentifrices even to the point of increasing or diminishing grit. These illustrations are a few of the many wherein a more general application of simplified prescription writing will be advantageous.

Another important aspect of this subject, which is just beginning to be appreciated, is the fact that the greater health service of which dentistry plays an important part is recognizing the necessity for cooperation of the important divisions of this service such as medicine, dentistry, nursing, public health service, pharmacy and sociology. For a number of years, medicine and dentistry have been cooperating in joint meetings, which have resulted in much good, but it is becoming more and more apparent that if medicine and dentistry succeed in rationalizing their materia medica and effectively protecting the public, the pharmacist must also be included in these joint discussions. From the joint meetings of dentists and pharmacists in my state, we have learned that the pharmacist cannot understand the indifferent attitude of the dentist in the writing of prescriptions, in view of what the apothecary knows he could and should be doing. The leaders in pharmacy are everywhere cognizant of the exploitation going on within their profession and are endeavoring to place the ethics of pharmacy on a higher plane. They believe that their position would be greatly improved by enlisting dentistry to greater cooperation and a better understanding of common problems. One needs but turn to the rather humiliating statement of George C. Schicks, dean of the College of Pharmacy, Rutgers University, who says that the druggist should teach the dentist how to write prescriptions. He suggests many prescriptions that the dentist might write. At a recent meeting of dentists and pharmacists, a pharmacist, a man of the greatest integrity in his profession, told the dentists how embarrassing it was to have patients present form prescriptions for proprietary medicines which the druggist, and frequently the patients themselves, knew were nothing more than the product of quackery. Such a situation can do nothing but lower public respect for our profession.

With the publication of Accepted Dental Remedies, every dentist has an authoritative source from which he may select his drugs. This makes prescription writing simpler and makes possible a degree of refinement in therapeutics. It will also raise dental practice to the status among the professions that its service deserves. This work is available at a cost of a dollar, and thus is accessible to every practicing dentist. From it, the practi-

tioner may judiciously refine his materia medica with adequate protection to both himself and his patients. He also may make notable savings in the cost of his medicines. Proprietary medicines are sold at many times any possible value that they might have. To illustrate, one of many preparations extensively used by dentists and sold under a nondescriptive name is marketed for 140 times its actual value. When a salesman attempts to sell you a new remedy, you may readily dispose of the case by asking him whether the product has been submitted to and accepted by the American Dental Association Council. And if not, why not. You will usually be told that so and so, a "prominent" dentist, recommends it; but have you observed in the journals how frequently one sees repudiations of these testimonials by prominent men whose names have been misused for sales purposes, indicating too frequently that the salesman is an impostor?

Any dental medicine requiring extensive advertising at this time should be carefully investigated before experimentation on patients. Many of the pain relievers fall in this class. Another illustration is that of topical anesthetics which were checked in the dental clinic of the University of Michigan by the experiments of Kenneth Easlick who failed to find a single topical anesthetic with even an approximation of a satisfactory value. One of these is quite typical of all of them. This, a highly advertised product, gave evidence that the manufacturer of the secret proprietary anesthetic solution had contributed nothing novel other than a method of selling a simple drug the action of which has long been known and was being sold for twenty times its market value under a secret name. I have asked research departments of creditable firms to help us develop such a product, for all are conscious of the importance of topical anesthesia, especially in children's dentistry. All also agree that no topical anesthetic is at present available that will do much more than digital pressure and a sharp needle. The simple, inexpensive ingredient indicated usually gives better results, if not diluted with other unscientifically chosen drugs of the shotgun description.

Many of you will now ask: Why has the Council on Therapeutics kept silent in view of its knowledge of the many existing cases of exploitation? The answer is simple: Our reports are the property of the American Dental Association. More than 100 products, investigated and reported for publication months ago, have not for some reason or another appeared in THE JOURNAL. It is indeed unfortunate that only those who have had a part in the investigation have so far been able to profit by the findings. Every member of the Council on Therapeutics regrets this delay. We have hopes that within the next year, the list of unacceptable dental remedies will be available to every member of the American Dental Association.

SUMMARY

1. It is gratifying to note that many practitioners on their own initiative have requested that graduate courses in pharmacology, materia medica and therapeutics be made available.

2. Pharmacologic research, now available to the practicing dentist, has made unusual progress during the past ten years.

3. A review of Accepted Dental Remedies gives ample evidence of the greater therapeutic refinement now possible to those interested.

4. With the mass of overexploited products, sold to both the dentist and the public, it is almost as important that the list of unacceptable dental remedies be

published as that the list of accepted dental remedies be.

5. Dentists and pharmacists should in every community cooperate with a view to greater service to the public and protection from nostrum racketeers.

6. Dentistry through the Council on Dental Therapeutics should give the greatest help and encouragement to manufacturers aiming at the preparation of honest products.

mately 100 drugs should be included. Of course, not a single member of the committee was of the opinion that this entire number would be continuously employed in practice. Frequently, it is as important to teach the action of drugs which are not to be used as it is to teach the action of those which are useful in order that the student will understand why a certain drug is not a wise choice in the treatment of a given condition. Certainly the well-trained dentist of today cannot reap the full measure of

APPENDIX

A		1st year.
B C		2nd year.
D E F		3rd year.
G H I J		4th year.
K L M N O		5th year.
P Q R S T U		6th year.
		etc.
A =	E =	I =
B =	F =	J =
C =	G =	K =
D =	H =	L =
M =	P =	S =
N =	Q =	T =
O =	R =	U =

This pyramid followed by a letter key, A, B, C, D, will make it clear to me for those who will communicate what your selection would be. You need only take the letters and place after them the drug that they represent. I will arrange the pyramid to conform with your key letters.

To illustrate: A might represent cocaine. If so, it should always represent cocaine wherever you place it in the pyramid. B might represent morphine. It too should always represent morphine wherever you place it in the pyramid. So all you need to do is to send me your alphabetical key. If cocaine would be your first choice, if only one drug could be used, then the key letter will be A, and if it were your drug of first choice, if two could be chosen, it would still be marked A in the pyramid.

DISCUSSION

J. R. Blayney, Chicago, Ill.: Dr. Rickert has set forth certain of the reasons that a practitioner of dentistry needs a thorough knowledge of drugs. It is my belief that the rather wide-spread use of nostrums is more or less the result of inadequate teaching of this subject. Recently, a subcommittee which studied the needs for a course on pharmacology reported to the American Association of Dental Schools that approxi-

enjoyment from his practice with a limitation of five or six drugs. Again, it is just as certain that the well-trained dentist of tomorrow will be expected to administer or prescribe drugs which are classed as hypnotics, anodynes, sedatives, cardiacs and cerebral stimulants, local anesthetics, hemostatics, cathartics and, in fewer instances, antipyretics, diaphoretics and diuretics. In most of these groups, we have a choice of several drugs. The therapeutist must have a sufficient understanding of these in order

to select the drug which will be most effective for the case at hand. Dr. Rickert has spoken concerning the necessity for dentists to write prescriptions; also of the frequent mistakes of using form prescriptions for a proprietary preparation. I concur that it is most important for the dentist to write prescriptions correctly and that form prescriptions never should be employed. Prescription writing is not difficult. If sufficient practice is required of students during their training, they can readily write prescriptions for whatever drugs they need in practice. The American Pharmaceutical Association is trying to develop a closer relationship with the dental profession. The society is endeavoring to inform the local pharmacist regarding the needs of dentists. I am sure you will find that the druggist much prefers to fill a prescription which you may write calling for either U.S.P. or N.F. preparations than to sell some proprietary through a form prescription. The American Pharmaceutical Association publishes a book entitled "The National Formulary." The sixth edition is now in the process of development. The board of editors has appointed a subcommittee on dental preparations, which has been working for some time to include those items of importance in dental practice. It is my belief that every dentist should have a copy of "The National Formulary." You will find many items that are not strictly dental which will be useful. I urge your support of the Accepted Dental Remedies, which has been prepared by the Council on Therapeutics. Through the activities of the Council, rationalism in dental therapeutics has been materially advanced and empiricism has been exposed. The Council is deserving of the whole-hearted support of the entire dental profession. Now that I have set forth additional evidence in the support of some of Dr. Rickert's statements and since you now understand my position on the question of limiting practitioners to five or six drugs, I shall try to answer Dr. Rickert's question concerning the selection of drugs to be used on some other planet. Many problems arise which will materially alter one's selection. We should know whether general surgery has been developed on this planet as it has on the earth. We should know whether such common preparations as table salt (sodium chloride), water and baseplate guttapercha (a protective) are to be classed as drugs. It is also important that we have a better understanding of both social and psychic development of the inhabitants. After taking the liberty of making my assumptions on conditions which are not definitely specified, I have made the following choice:

A	1st year.
B C	2nd year.
B C D	3rd year.
A B C D	4th year.
A B C D E	5th year.
A B C D E F	6th year.
A B C D E F G	7th year.
A B C D E F G H	8th year.

A, eugenol (as an antiseptic and obtundent).

B, procaine and epinephrine (as an anesthetic).

C, tincture of iodine (as an antiseptic).

D, sodium chloride (physiologic salt solution).

E, sodium barbital (hypnotic and preanesthetic medicament).

F, acetylsalicylic acid (as a stimulant).

G, caffein citrate (as a stimulant).

H, magnesium citrate.

If you will return to your practice and make a serious effort to write prescriptions calling for the different classes of drugs which may be indicated, without doubt you will materially increase your enjoyment of the practice of the "science and art of therapeutics."

Samuel M. Gordon, Chicago, Ill.: One who undertakes to write a paper on dental medicine undertakes a handful. The subject has many ramifications, each of which may serve as the subject of any number of papers. Dr. Rickert approaches the problem both as a teacher and as a counselor. Dr. Rickert could tell of many instances in which neophytic practitioners have come to him for advice on the essential drugs. He has developed the pyramid of which he spoke. His imagination is sane and practi-

cal, for are we not constantly reminded that organizations such as the United States Army and Navy and exploring expeditions are faced with similar problems? There must be no excess baggage. No one will contend that dental or medical practice is inferior because of such restrictions. These very restrictions develop a keenness that is sometimes missed when there is a superabundance of drugs and instruments. I admire the pioneers of dentistry who were able to do as much as they did with the meager equipment available. The movement to extend the scope of the dental curriculum is emphasizing more than before the study of materia medica, pharmacology and therapeutics. It would be unfortunate if the scope were increased simply by adding more drugs. It would prove valuable if more time were spent in discussing certain drugs of each pharmacologic or therapeutic group of drugs of interest in dental practice. Three examples will bear out the possible usefulness of this approach. Let us compare epinephrine and substances related to it chemically. Epinephrine exists in three forms. The levorotatory substance is the commonly used one; the dextrorotatory substance is one-fourteenth as strong, while the biologic actions of the inactive form partake of both. Thus, if one wished to obtain the vasoconstricting action of levoepinephrine, but had only the dextro form available, he would of necessity use fourteen times as much. The same reasoning applies to a new compound related to epinephrine, whatever its name. There may be minor variations, but the degree of their importance should depend not on the optimism, to speak mildly, of the manufacturer or distributor, but on the available scientific evidence as to how much better the new substance really is. Thus, the acceptability of the new substance depends in some measure on the way that it is advertised. The same reasoning is applicable to the large group of drugs that have local anesthetic action, either by entrance through the intact mucous membrane or by hypodermic injection. While there are a great number available, it is not necessary to study all of these in detail. Extensive knowledge of the actions and uses of cocaine with few modifications may be transferred to all the synthetic substitutes which are related physiologically to cocaine. It is true, of course, that cocaine today has not the extensive use in dentistry that it had before the introduction of procaine. It is, nevertheless, a significant fact that most of the fundamental pharmacologic and therapeutic studies of this group of drugs begin with cocaine as a standard. Rapidity of reaction, length of anesthesia and various by-reactions of the therapeutic analogs are referred to cocaine. Hardly a month passes but some new topical anesthetic is introduced to the profession, not by distinguished members of the calling, or as the result of some research, but by someone who wants to turn a dollar. I refer now to the group of proprietary "topical anesthetics." Many trade names can be listed. The composition of one of these trademarked products will be the same as the rest. Most of them contain the well-known drug, ethyl aminobenzoate (benzocaine). The properties of this drug are well described in the literature, but, by some magical ink, these are endowed with properties that were not uncovered by careful and critical investigators. This necromantic ink succeeds in extracting from the profession $2.50 for about 9 cents worth of material. It need hardly be said that the enthusiasm of the dentist invoked by the advertising is dissipated before the contents of the first bottle are used. Dr. Rickert has pointed out that some of these products yield no more local anesthesia than would be obtained by digital pressure or possibly by the use of alcohol. Dr. Rickert no doubt will also agree that some drugs can pass through the intact mucous membrane, and some of these may be useful, such as cocaine, butyn, tutocaine, benzyl alcohol and possibly saligenin. Another large class are the hypnotics. The Council pointed out in a report on the uses and abuses of barbital that new compounds related to barbituric acid appear in the literature almost every week. From a chemical viewpoint, the reason is simple. Pharmacologic studies show that their actions are all fundamentally the same, and that they differ, as in the case of

epinephrine already discussed, only in degree. While some are said to have a more effective action from lower doses and more prompt elimination, the truth of the situation has appeared in a Council report—that with the amplification of activity, there is also amplification of toxicity. No information which has yet appeared has been able to controvert this fundamental fact of drug action. Thus, by learning well the actions of the parent substance, barbital, in theory and practice, one has a good idea of what related compounds will do. If the dentist seeks for fundamental information on proprietary products in most textbooks on dental pharmacology and therapeutics, he will be somewhat disappointed. The Council on Dental Therapeutics is making an attempt to make available to the members of the dental and allied professions concise, unbiased and authoritative information on the official drugs and acceptable proprietaries useful in dentistry. There is now available, as Dr. Rickert has mentioned, the little book Accepted Dental Remedies, which sells for $1. When used with a little thought, it will enable the dentist to employ drugs efficiently, and moreover at a great economic saving. This applies to drugs not only for local action, but also for systemic action. How the book may be used can be illustrated by a recent experience. Some time ago, a practitioner who had for years been using "stock" solutions of local anesthesia was particularly distressed by a run of "dry sockets" that he had been obtaining. He also felt that he was paying more than he should for these "stock" solutions. The problem was discussed between us. He was advised that if he wished the convenience of the "stock" solutions, he should expect to pay for it. If he desired to do a little experimenting of a safe nature, a solution to the problem might be found. The result was that this dentist returned to the "old fashioned" way of making his own solution. This is his recipe:

Procaine hydrochloride		5 gm.
Sodium chloride		1.25 gm.
Calcium chloride		0.1 gm.
Potassium chloride		0.05 gm.
Water	q.s. ad	250 c.c.

This is made up and kept continuously in a pyrex bottle. In another bottle, 10 c.c. of 2 per cent sodium carbonate solution is made up. In making a solution for use, to whatever is measured off, 1 drop of the sodium carbonate solution is added to every 2 c.c. of Solution 1, and 1 drop of epinephrine to each 2 c.c. of Solution 1. The solution is then ready for immediate use. The boiling, of course, should be done before the epinephrine is added. It takes only a minute to prepare, and everything is ready. This dentist now writes, "I use the foregoing solution and am quite happy with it, though, to be sure, we do get some dry sockets occasionally." In this vein, one can discuss pulp capping materials, drugs for hypersensitive dentin, drugs for root-canal therapy and drugs for Vincent's infection, pyorrhea and other conditions of dentistry. But the above-quoted remarks indicate what may be expected of using intelligently the information now available in Accepted Dental Remedies. Different from Dr. Rickert's suggestion, and one that rests on a proven basis is that to use rules such as the Council follows in considering the worthiness of an article. I shall not bore you with a recitation of the rules, but merely remind you that they refer to nonsecrecy of composition, advertising to your patients and to yourself, supportable claims, unscientific mixtures and the naming of new products. With a knowledge of the rules before you, let us pose the question, what would be the state of our materia medica if there had been in existence a body like the Council on Dental Therapeutics in the early days of dental history, and if their findings were made legal. My guess is that the armamentarium would be much more respected than it is now. This is not merely an opinion or a wish. I will not take your time to compare conditions in the medical field twenty-five years ago and conditions today. I may express the feeling that the state of dental therapeutics today is much healthier than it was five years ago. The important point is that a start has been made in urging dentists to look into their materia medica, critically and thoroughly. This will lead to better textbooks, better teaching and better

practice, with much saving of health and expense. Finally, I join Dr. Rickert in reminding you that the office of the Council on Dental Therapeutics is no farther away from your office than a postage stamp. Let it help you to solve your drug problems.

FUNGUS INFECTIONS OF THE ORAL CAVITY*

By T. A. HARDGROVE, Fond du Lac, Wis.

THE chief report that I wish to make at this meeting is on two types of fungus infection. The first one, caused by an organism known as *Endomyces vuillemini,* is one of the yeast fungi. It has been my observation that this fungus attacks chiefly the epithelium of the oral cavity down as far as or a little below the floor of the mouth, but it does not seem to thrive below that point, probably owing to the fact that it comes in contact with different types of flora.

In one case, the beginning of the trouble was mistaken at first for a Vincent's infection of the oral cavity. Very shortly afterwards, a disturbance of the nasal cavity began, and a mistaken diagnosis resulted in an effort to remove some spurs. Clinically, the condition had the chronic symptoms of a fungus infection, particularly the blastomycosis or yeast infection, of which it proved to be one type. The whole length of time until the diagnosis was made was five months. There were many consultations and much treatment was advocated, but no satisfactory treatment was rendered until the diagnosis was properly made. Once the condition was correctly diagnosed, the treatment was indicated and the patient recovered in a very short time. In this case, the treatment consisted of large and continuous doses of potassium iodide with exposure to the roentgen rays. The patient did not make any decided permanent improvement until the roentgen-ray therapy was added to the use of potassium iodide; nor did he improve with the roentgen therapy alone or with the use of the potassium iodide alone. That is one of the peculiar things about fungus infections, the different types seeming to attack different tissues and requiring different treatment.

In the case of a monilia, arsphenamine seems to be the remedy that will bring about the quickest result; while in the presence of the endomyces, as in this case, both the roentgen rays and potassium iodide are required, and arsphenamine is of no use as a curative. In this particular case, the nasal bones were attacked and destroyed even to the ethmoid, a large part of which was removed through the nasal opening (by Dr. Gardner of Fond du Lac). The patient now has an opening through the separating tissues of the nose. He has lost enough bone from the left antrum that the antrum is now open. The patient was so ill that he nearly lost his life.

After making an effort for some time to diagnose the case correctly, we suggested that the patient go to the university hospital with an idea of determin-

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

ing the diagnosis. After a continuous effort of twenty-nine days, the diagnosis was still indefinite. In all of these cases of fungus infection, the mistake is made of not permitting the culture to grow long enough. This growth could not be demonstrated until the culture had grown for six days.

The chief thing that I want you to observe is that the classification of these organisms is very important because it indicates the type of treatment as well as the type of tissue attacked. In the case of monilia, the attack is made on the connective tissue. In the case of endomyces, the attack is made on the epithelium chiefly. Other tissues are affected only by the nutritional supply, which comes through the mucous membrane's being cut off.

In another type of case, the patient has a fungus infection of the palate and continuous tissues, but not out on the mucous membrane lining, cheeks or lips. This infection has continued over a period of twenty years, with a continuous effort almost all of the time to control the disease. This type, although no particular classification could be made, is simply diagnosed as a yeast. Stitt[1] says that the diagnosis of blastomycosis is always a matter for the laboratory. The main dependence is on the microscopic method backed by the culture. In all scientific work, the clinical picture should not be lost sight of. This type of infection seems to grow on the epithelial surface, but it is attached in some manner to the basement membrane underlying the epithelium. It makes no attack on the bone or other tissues.

It does not seem to resemble the ordinary yeast because it does not apparently respond to potassium iodide. The patient above mentioned does not tolerate potassium iodide, which probably makes treatment of his case more difficult. Nor in this case do the roentgen rays render a great service. The infection seems to be local in character. It is characterized by a very white growth on the palate, which looks not unlike snow scattered over a surface. The treatment that is of greatest benefit is the utilization of some agency that dissolves the white fungus. It is pure white, tough and hard to remove. If we remove it in its entirety, we have to go beneath the epithelium and into the connective tissues. It would then bleed considerably and recur in a short time. Removal with a cautery seems to be very unsatisfactory and dangerous. Removal by incision or biopsy seems to be more satisfactory, but the growth reappears. The first application of the roentgen rays seemed to make a decided improvement. Subsequent roentgen therapy seemed to be of no value. After the white surface is dissolved from the palate, orthoform, a form of iodine, which seems to be of value to the patient, is blown onto the palate.

In the beginning, this patient could not tolerate any food that was acid or sweet. The condition has improved about 80 per cent. I am unable to overcome the remaining 20 per cent of infection.

Dr. White of Chicago saw this case and said that, for the purpose of diagnosis, he would call it thrush. The trouble with the teaching of pathology in the past with reference to thrush was that the student was led to believe that the name "thrush" indicated a disease caused by a specific organism, when, in reality, so-called thrush has been modified a great many times since its first discovery. Dr. White thought that we would never be able to cure this lesion. It is beginning to look as if he were correct in a degree at least in that statement. The patient is much more comfortable and will undoubtedly make some im-

provement from now on as a better knowledge of his condition is had from time to time.

It is my conclusion that this case belongs to a definite classification of yeast fungus, but as yet we are unable to classify it satisfactorily. There is a great dispute as to the classification of yeast fungus. This infection resembles what we would call *mucor mucedo,* although I would not want to say that as a definite diagnosis. Clinically, it resembles that type.

Castellani has probably reported more of those cases than anybody else, but not in the oral cavity. Just recently, Stovall, of the University of Wisconsin, has made an attempt to simplify the classifications of yeast fungus. In the case of monilia alone, he has reduced the number of that classification from about fifty-six to something less than twenty-five. He did that by the use of culture mediums.

At a previous meeting, I referred to a very outstanding case of monilia and I am going to add the statement that, in the case of the monilia at least, there is a great danger of blood changes occurring. This patient, a man, became sick a year after his recovery from a monilia infection, that is, since we reported this case. He developed an aleukemia of some sort from which he did not recover. There is a great need for prolonged treatment after the symptoms have disappeared. We must bear in mind the possibilities of related disease and mixed infection. The treatment required for the destruction of a fungus in many cases is a drastic one, and the patient is apt to be reduced in nutrition; which emphasizes the importance of a very rigid or intelligent metabolic effort as a conjunctive measure in the treatment of fungus infection.

I have a picture of an actinomycosis which is quite outstanding, since it practically makes a diagnosis of actinomycosis by the use of the roentgen rays. This case, which was one of Dr. Twohig's, of Fond du Lac, was found to be definitely a fungus infection.

CONCLUSION

While the diagnosis must be made by the microscope and culture method, the clinical symptoms should be taken into consideration and given proper weight. A very systematic effort should be made to recognize the classifications if possible. The whole family leading up to the classification should be studied. The importance of a prolonged growth of the culture should be emphasized. These patients do not have much temperature or disturbance of the pulse, and, in some cases, do not have much change in white blood in the beginning. The changes are liable to come later, as the disease progresses, and even after the patient has apparently recovered.

In the case of a monilia, the white blood count at one stage went as high as 59,500 and the patient became terribly emaciated. While in the case of the endomyces, the blood count was never badly disturbed, pain was the most terrific thing the patient had to contend with, while, in the ordinary yeast infection, pain did not seem to be such an important factor.

I am calling attention to these fungus infections of the oral cavity particularly because no extensive work has been done in that field in the oral cavity, and, after all, when a diagnosis is made, the treatment is quite simple. In a general way, all fungi should yield to iodine and roentgen-ray therapy, but they do not all do so.

Croti, of Columbus, Ohio, claims that thyroid disturbance is due to a fungus and has isolated a fungus from a re-

moved thyroid and injected dogs and produced a thyroid condition. He finds this fungus on cabbage. This may be one reason that certain types of thyroid disturbance yield to large doses of iodine, or that iodine is administered in a great many cases of thyroid in preparation for operation.

SIMPLIFIED INLAY CASTING*

By HERBERT D. COY, D.D.S., Hamburg, Iowa

A PAPER describing an inlay technic must of necessity be monotonous, since so much of it is repetition.

Virtually every step, in the manner of procedure herewith noted, has been developed through the coordinated ideas of others, and through some of the oldest principles of dentistry.

My only purpose in writing this paper is that others may learn, as I have, of a method for use in achieving an accurate casting with the utmost simplicity, a method which eliminates much of the uncertainty and the fear of a misfit, which was ever present in most of the early methods.

In former papers, I have outlined the different steps in my casting technic. These I will review briefly, to recall to you the mode of procedure.

METHOD

1. The casting shrinkage of inlay golds is approximately 1.25 per cent. Conditions which may be made to balance this shrinkage are to be so controlled that the total compensation will equal approximately 1.25 per cent. As several fundamentally sound and usable technics have been developed, the exact manner in which the factors are to be combined is largely a matter of personal choice.

All materials used in any technic should be carefully checked against the Bureau of Standards' specifications to determine their reliability and dependability. Many technics using unstandardized materials are still being pushed onto the profession by commercial interests.

By the use of materials having known and definite physical properties, castings of predetermined size can be made with comparative ease, making it possible to fit cavities or molds of the most severe type.

2. The wax pattern is secured by any satisfactory method, a wax that meets the specifications of the American Dental Association being held in the cavity under pressure, while it assumes mouth temperature. These waxes have an average thermal expansion of 0.02 per cent for each degree of change in temperature.

3. In placing the sprue, it is better not to insert a heated pin in the wax pattern, but to add a small amount of wax at the desired point and attach the pin in it, using a sprue from 13 to 18 gage in diameter, in accordance with the size of the pattern.

4. The pattern is mounted on a crucible former with about one-third inch

*The papers of Drs. Coy, Phillips and Scheu were presented as a symposium on "Inlay Casting Technic."

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

between the pattern and the crucible former base.

5. The pattern is cleaned with a solution composed of equal parts of hydrogen peroxide and tincture of green soap, rinsed in room temperature water and dried with an air syringe.

6. Room temperature water, 16 c.c., and investment, 50 gm., are placed in a clean, dry plaster bowl and spatulated with a mechanical spatulator, with 300 turns of the blade or 100 turns of the handle.

One end of the ring is sealed to a metal slab with beeswax and the investment is vibrated into a previously moistened asbestos lined ring.

The investment is applied to the pattern with a small camel's hair brush, being vibrated slightly if necessary.

The investment covered pattern is gently vibrated into the investment filled ring until the crucible former base is seated and allowed to set for twenty minutes.

7. If the room temperature is between 80 and 85 F., the investment may be allowed to set on the laboratory bench. In offices, where it shows a greater variation, the temperature of the invested pattern should be stabilized in a water bath while the investment is setting.

8. Elimination is started on low heat, the temperature being gradually increased until a dull cherry red is visible through the sprue hole.

Casting is done immediately on taking the ring from the eliminator, so that no shrinkage will occur owing to the loss of heat therefrom.

9. The setting expansion is approximately 0.41 per cent, the thermal expansion, approximately 1.00 per cent; total, 1.41 per cent.

That there may not be any uncertainty as to the how, when and why of the steps set forth in the foregoing outline, the questions most frequently asked me at dental meetings are here answered.

QUESTIONS

1. How do you know that the shrinkage of gold from the molten state to the point of crystalization is approximately 1.25 per cent?

This figure varies up to 1.35 per cent for some types of gold. The National Bureau of Standards, after an exhaustive study gave the profession the information that 1.25 per cent was the approximate shrinkage of most inlay golds.

2. How should an inlay wax be selected?

The American Dental Association, through its work with the National Bureau of Standards, established specifications for inlay waxes. Any manufacturer whose wax meets the specification has the privilege of certifying the fact to the A.D.A. Research Commission. The waxes so certified are: Kerr's Blue Hard. Peck's Blue, Peck's Purple, Maves and Brewster's. I would select one of these for my inlay work.

3. In making a wax pattern of a cavity, why is it necessary to keep the wax under pressure until it has hardened?

Owing to its elastic properties, wax has a tendency to return to its original form. A change in temperature causes a volumetric change in the wax so that, as it cools, there is a tendency for it to draw away from the cavity walls and margins, if it is not held under pressure.

4. Do you prefer the direct or the indirect method of making a wax pattern?

I prefer the direct method of making a wax pattern, because, in the box type cavity, which I also prefer, it is just as easy to make a wax pattern as it is to make a compound impression. The reverse is true of the slice type of cavity. The direct method also eliminates sev-

eral variables and saves much time in construction.

5. Why do you use an investment that meets the specifications of the American Dental Association?

Because an investment that meets the specifications of the American Dental Association has known and definite physical properties which can be so controlled and so regulated that any desired compensation can be obtained. The investments that have been certified to the A.D.A. Research Commission are:

Ransom & Randolph's Green, Ransom & Randolph's Gray, Coe Inlay, Coe Universal, Kerr No. 3, Ransom & Randolph's X 45, Kerr Cristobalite Inlay and Kerr Cristobalite Model.

6. Give your reasons for sealing one end of the ring with a metal slab.

One end of the ring is sealed to a metal slab with beeswax to make a closed container, into which the investment may be poured or vibrated. This makes it unnecessary to vibrate the investment onto the wax pattern. Vibration of a wax pattern, after the investment surrounds it, has a tendency to cause roughness of the casting, because of the water film which collects next to the pattern. This method also closes both ends of the ring, when investing is complete, so that it may be placed in a water bath if desired.

7. Why should a water bath be used?

There are many dentists who maintain that the water bath is superfluous. It is readily admitted that fairly accurate castings can be made without its use. For those who strive for perfect accuracy, it is indispensable.

The average expansion of wax is 0.02 per cent for each degree Fahrenheit temperature change. To illustrate: The temperature change from the mouth, 95 F., to a room temperature of 75 F. is 20 F. This multiplied by 0.02 gives 40 per cent. Thus, it may be seen that a wax pattern, in a room temperature of 75 F. is 0.4 per cent smaller than when taken from the cavity in the mouth. This loss must be added to the shrinkage of the gold and compensation made for it. This could easily be done with investment expansion, if room temperature were always constant.

In offices where the temperature fluctuates over a wide range, it is much more desirable to establish an artificial temperature by submitting the invested pattern to a water bath, thereby definitely establishing the size of the wax pattern.

8. Why is the inside of the ring lined with asbestos?

The inside of the ring is lined with asbestos to provide an expansion cushion, which permits the setting expansion of the investment to take place in a horizontal plane.

9. Why do you spatulate the investment with a mechanical spatulator?

To thoroughly incorporate the investment and water and to eliminate the air from the mixture, it is necessary to spatulate it with a mechanical spatulator. This was established through microscopic tests and clinical demonstrations.

10. Is it necessary to proportion the water and the investment accurately?

Yes, because the thermal and setting expansion is in direct relationship to the amount of water in the mix. It is impossible to guess the proportions.

11. What size sprue is preferable?

The sprue should be reasonably large and quite short for the reason that the gold should flow to the mold as quickly and with as little restriction as possible.

12. When do you use a matrix and what kind do you use to confine the wax in making a pattern?

The use of a confining matrix is usually necessary in compound cavities. If a matrix is used, it should be so adapted that it will permit the flow of wax over

the cavity margins, especially the gingival margin. It should be shaped to permit the closing of the teeth in centric relationship and be easily removed without distorting the pattern.

13. Do you prefer the box type or the slice cavity preparation?

The system of cavity preparation given to the profession by G. V. Black has stood the test of time. It was developed through years of study of the principles involved and needs but slight modification to make it adaptable to inlay work.

Conservation of the tooth structure and the protection of the pulp should be given first consideration in the preparation of any cavity. An inlay cavity may be narrower mesiodistally than a cavity for foil or amalgam, but it is essential that the fundamental principles of cavity preparation be observed in that it should be of the box type, with a definite cervical floor.

A Black type of cavity, in which a comparatively much softer gold may be used, does not constitute so great a hazard to the dental pulp as does a slice cavity, in which a very hard gold has been used, with no heed to the traumatism which may follow owing to the natural wear of the tooth structure, allowing the hard gold to bear the entire stress of occlusion.

In preparing a cavity for an inlay, we should be conservative in our cutting, securing finer details in the angles and point angles; keep frictional heat at a minimum; remove all decay, and insert a cement in deep cavities as a nonconductor. If these rules are observed, there will be little danger of injuring the pulp.

14. How do you dry the mold and eliminate the wax?

After the investment has set, the metal slab, the crucible former and the sprue pin are removed. The ring is then placed in the furnace, and very slowly heated, the heat being gradually increased until a dull cherry red is visible through the sprue hole, at which point the casting should be made.

Elimination can be accomplished with an open flame, if no furnace is available.

The casting should be made immediately on removing the ring from the heat, to avoid shrinkage due to loss of heat from the mold.

15. What type of casting machine is most adaptable?

The type of casting machine to be used is largely a matter of individual choice, so long as one is selected that will force the gold to place.

16. What gold do you use?

The gold selected for the casting should be one which meets the specifications of the American Dental Association. This specification divides gold for dental casting into three groups, namely A, B and C. Type A is a soft gold and should be used in all simple and most compound cavities, where the stress is not too heavy. Type B can be used in cases of moderate stress. Type C should be used in cases of high stress, such as three-quarter crowns, thin cast backings and full crowns and in other similar operations. Most of the manufacturers can now supply golds that meet these specifications.

17. Do you use gold substitutes for inlays?

No. The cost of gold represents a very small part of the expense of making an inlay. The saving represented in using a gold substitute is not large enough to justify sacrificing the many known high qualities of gold, which cannot be questioned, for a material of uncertain physical and functional value. The ultimate results are too uncertain to recommend it to the profession.

18. What flame is best for melting golds?

In melting gold on the crucible, a large brush flame should be used at the start. When the gold begins to show red, the flame is sharpened by feeding a little more air and the torch held slightly closer to the crucible. The heating is continued until the surface of the gold has a clear bright appearance. Without removing the flame, the metal is instantly cast.

A minimum amount of oxidization will be experienced, if the flame is applied in such manner that the apex of the reducing cone of the flame is always in contact with the gold.

19. What is your method of cementing an inlay?

Whenever possible, the rubber dam should be applied, because it is absolutely essential to keep the cement dry while it is setting. Clean the cavity, first with hydrogen peroxide, to remove the blood and mucin, then with chloroform, to remove any grease or wax sediments not removed by the peroxide. Then wash the cavity with distilled water, drying out the excess with cotton pellets and slight blasts from an air syringe. Do not dehydrate the cavity with alcohol or other agents just before applying the cement. A certain amount of moisture should be left in the tooth structure to prevent the phosphoric acid from penetrating the dentinal tubules.

It is quite likely that reliable data will soon be furnished by the National Bureau of Standards to assist members of the profession in selecting and handling cements, but until this information is available, it is safe to say that whatever brand of cement you choose to use should be mixed as thickly as possible to still permit seating of the inlay. A cool slab and definite proportions of liquid and powder are used each time. The inlay should always be held under heavy pressure, and kept free from moisture, until the cement has hardened.

20. What step do you consider most important in making an inlay?

No one step can be said to be more important than another. It is absolutely essential that each step be faithfully and carefully executed so that the inlay, when completed, will result in a restoration that will be a creditable reproduction of the original tooth in form and function and will render years of useful service.

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CONTROLLED CASTING*

By DAVID W. PHILLIPS, D.D.S., Chicago, Ill.

TODAY, gold inlays can be consistently cast under dimensional control and finished with marginal adaptation comparable to that of the classic standard of excellence, the gold foil filling.

The concept that the cast gold inlay was and still is an imperfect restoration was born of the years of uncontrolled casting. Tennyson reminds us that "Verily the old order changeth giving place to the new." An old idea must yield to a new and constructive ideal, not a rhetorical ideal, but a practical and attainable one.

I grant that the perfect inlay has never been cast, but I maintain that the perfect foil has not been malletted. It has been "fittingly" finished by burnishing the gold directly against the enamel margins of the tooth.

Likewise, dimensionally controlled castings can be "fittingly" finished in the same manner, by burnishing the gold directly against the enamel margins of the tooth itself before cementation. The use of inlay golds as soft and burnishable as existing stress conditions warrant facilitates this procedure.

Over a period of years, there have been noteworthy improvements in the materials employed in the casting process, simplification of method, the achievement of exactitude and a more thorough understanding of the physical phenomena appertaining to dental technic. Definite and delicate control of casting dimensions is now an accomplished fact, but improvement in the casting art has been gradual, the result of the contributions of many. It has been a process of evolution, not revolution.

It is interesting to note that the casting procedure in use today is essentially the process presented to us by the ingenious Taggart over twenty-seven years ago. Even the materials employed, the waxes and investments, are fundamentally similar. The most modern inlay investments are still essentially a plaster binder and a silicon dioxide refractory. Cristobalite, though chemically the same as quartz, is silicon dioxide converted allotropically, with physical characteristics previously unequaled for inlay investment purposes.

CONTROL

I employ the term "controlled casting" as phraseology more suggestive and significant than the heretofore loosely applied phrase "precision casting." Certainly, the exactitude attainable today represents a more nearly perfect fit than the so-called precision casting of yesterday, when the accuracy of the adaptation of a casting varied with the type of preparation being fitted.

*From the College of Dentistry, University of Illinois, Department of Crown and Bridge.

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

Controlled casting connotes not only control of compensatory expansion, but control as well of casting dimensions, the prime requisite of casting accuracy.

An exact casting is no longer a fortunate accident. Cavity preparation retains its difficulties, and securing a pattern which is a faithful reproduction of the cavity is still an art; but the laboratory procedure has been so simplified and standardized that exactitude in this part of inlay work is by far the least difficult part of the whole procedure.

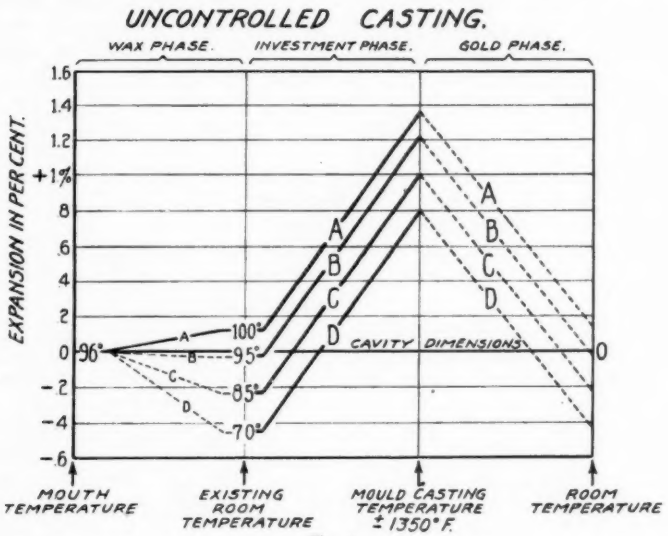


Fig. 1.

CLASSIFICATION OF TECHNICS

In the study of casting, we find that the laboratory procedure for making inlays as practiced today falls into two general classes: (1) controlled technic; in which shrinkage and expansion of the materials employed are correctly balanced in their practical application, and by means of which inlays are consistently cast to exact cavity dimensions; (2) uncontrolled or haphazard technic (of which there are many); in which pattern investing temperatures are ignored, shrinkage and expansion are not consistently balanced, and by means of which casting exactitude is only occasionally attained.

Some method of controlling dimensions is absolutely necessary to assure consistent casting accuracy. A casting technic without control is just hit or miss, or haphazard, with results satisfactory only to the less discriminating. Those who are satisfied with such results will not be interested in controlled casting.

METHODS OF CONTROL

Today, we have three different methods for effecting dimensional control for precise casting work. In the first and second methods, the pattern is reheated to a stabilizing temperature by means of a water bath. In the third, the invest-

ment expansion control method, patterns are invested at prevailing room temperatures and dimensional control is automatically built into the investment itself by means of expansion control powder and the automatic scale.

The first controlled technic was the conventional water bath method. Closely identified with this important advancement in casting are the names of Van Horn, Price and Meyer, and the United States Bureau of Standards, which has done so much to develop the interest of the profession in precision casting. This technic is demonstrated at its best by Coy.[1]

The second controlled technic was Scheu's method[2] of employing the hygroscopic expansion of setting plaster in conjunction with the water bath; an original contribution.

A fair-minded investigator will admit that excellent results are attainable by either of these water-bath methods of controlling casting dimensions. They are well known and are worthy of anyone's time and effort. A discussion of their advantages or shortcomings is not within the province of this paper. It is, rather, the intent to present the general picture of precise casting by all three controlled methods, to explain and interpret the advantages of the control system and to promulgate a most practical precision requirement, expansion variation for different types of patterns.

Casting research of the last few years has been directed primarily toward achieving exactness, irrespective of the dimensional variation of the pattern when invested at different room temperatures.

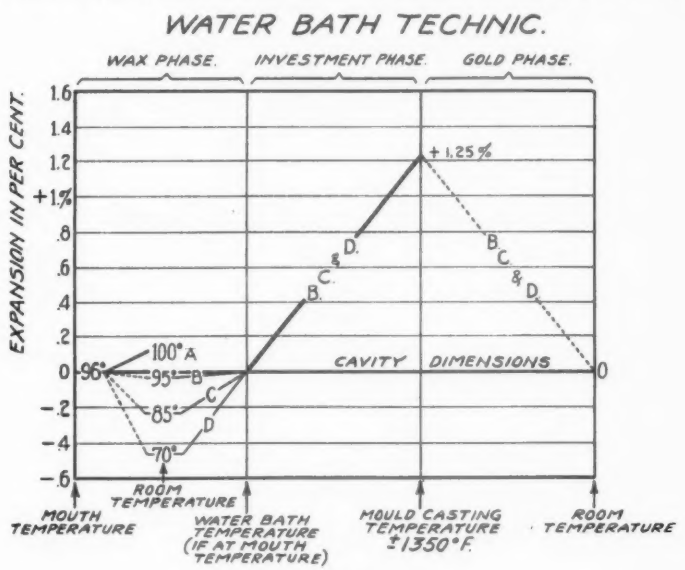


Fig. 2.

1. Coy, H. D.: Application of Recent Developments in Inlay Casting, J.A.D.A., 20: 212-218 (Feb.) 1933.

2. Scheu, C. H.: New Precision Casting Technic, J.A.D.A., 19:630-633 (April) 1932.

The control method realizes this objective in a simple and novel way.

It is essential that certain significant physical fundamentals of correct casting be understood, because progress in this art, particularly as represented by improved results in the hands of the great majority, depends largely on comprehension of the important basic principles. Haphazard methods will be abandoned only as more dentists acquire a thorough understanding of the theory and practical application of the "compensation" principle and the futility of any technic that fails to recognize that major variable, investing temperature.

If we have an intelligent appreciation of the difficulties which beset us in the casting process, we are far more likely to win the coveted rewards of excellence in this work.

In order to present a graphic picture of what takes place when an inlay is invested and cast, a series of diagrams are presented similar to one I have used to explain the *modus operandi* of the control method.[3] This type of graph, substituted for the isolated wax expansion and investment expansion charts usually employed, permits us to visualize the process as a whole. It has proved very helpful in elucidating the theory and practice of casting, particularly to students. The diagrams are broadly based upon average conditions for uniformity and illustrative purposes.

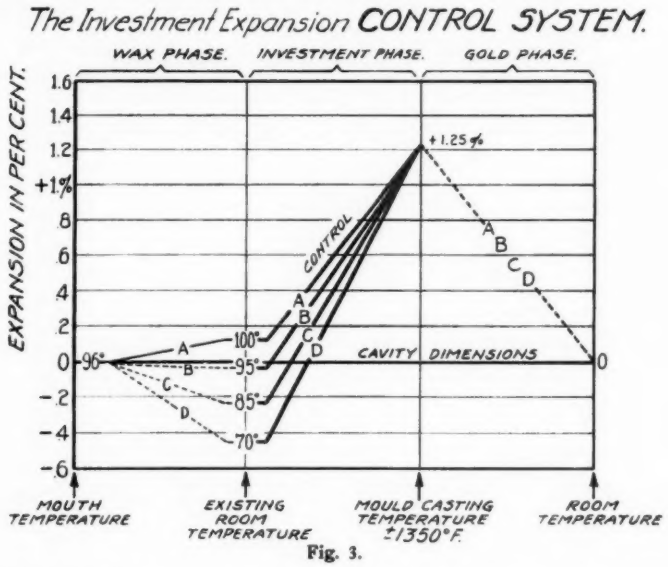


Fig. 3.

In these diagrams (Figs. 1-3), beginning with the pattern adapted to a tooth in the mouth and ending with the completed casting, the investing and casting picture has been logically and chronologically divided into three phases: the wax; the investment, and the gold or casting metal. Note that each phase derives its name from the material subject

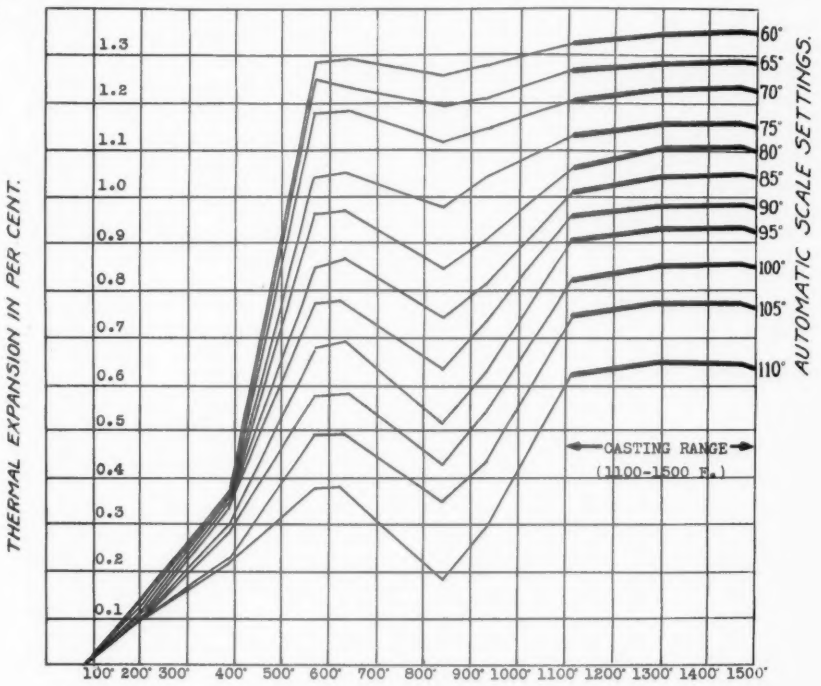
3. Phillips, D. W.: Control Method of Correct Casting, Iowa D. Bull., 20:6-18 (Feb.) 1934.

to dimensional variation employed in that phase.

Horizontally through the graphs, we find the zero line, which represents cavity dimensions, the dimensions of the pattern adapted to the tooth at mouth temperature at the extreme left, and, if the technic is correct, the dimensions of the cooled casting at the right end. The lines above the zero line measure expansion above cavity dimensions in percentage, and those below register shrinkage.

Understanding of the casting process is facilitated because, in these diagrams, dimensions, at any stage of the process, can be definitely noted in relation to that governing gage, cavity dimensions. The investing and casting of several patterns can be traced on the same graph and comparative results noted. Each letter represents a complete investing, burning out and casting operation of one pattern under one given condition.

In the first phase, the wax phase, the extraordinary expansion and shrinkage properties of wax are illustrated. It depicts the important dimensional changes which take place in the pattern when it is removed from the mouth at about 96 F. and assumes the existing room temperature, whatever that may happen to be. Pattern dimensions may vary from a



THERMAL EXPANSION CURVES OF "CONTROL" INVESTMENTS.

Fig. 4.

shrinkage below cavity dimensions of over 0.4 per cent at ordinary room temperature to an actual expansion of about 0.2 per cent at summer temperatures.

The pattern is of approximate cavity dimensions only when the room temperature approaches mouth temperature. Therefore, duplicating the pattern is fallacious casting; a pattern invested at room temperature is rarely of cavity dimensions.

This temperature-dimensional variable of wax has long been the bugbear of accurate casting. It has been responsible for failure to cast exact inlays when patterns were invested at prevailing room temperatures, until the control system was developed to offset this variable automatically.

Must we not class as haphazard or uncontrolled all technics which ignore varying investing temperatures and the resulting dimensional changes in the wax pattern and casting?

The second phase, the investment phase, begins when the investment starts to set about the pattern, and ends when the investment mold is burned out, completely expanded and ready for casting. The "effective" setting and the thermal expansion of investment are represented in this phase. It is a physical fact that the mold cavity enlarges with the expansion of the investment.

Controlled investment expansion alone, without any wax expansion to a stabilizing temperature, is employed in the control system to compensate for both the dimensional changes which have previously occurred in the pattern and the gold shrinkage which is to follow.

It is manifest that, if the finished casting is to equal cavity dimensions, the expansion of the mold at the casting temperature must at all times reach a point 1.25 per cent above cavity dimensions, in order to compensate for the shrinkage of gold in cooling, about 1.25 per cent.

The third phase, the gold phase, represents the more or less constant shrinkage of gold. Fortunately, the casting shrinkage of the gold alloys used in casting is a relative constant of approximately 1.25 per cent, depending on the composition of the particular alloy employed. With an accurate technic, even variation from this figure can be detected when castings are made for a 2 per cent taper metal die.

UNCONTROLLED CASTING

Figure 1 illustrates uncontrolled casting at its best. The dimensional changes in the pattern when it is removed from the mouth and assumes existing room temperature, depicted in the wax phase, may be noted.

In the investment phase, an investment is represented with fixed expansion properties exactly compensatory for the shrinkage of gold, 1.25 per cent, so that the dimensions of the patterns at room temperature at the time of investing are faithfully duplicated, but changes in investing room temperatures and the resulting variations in the size of the pattern have not been considered and the finished castings at the extreme right are all undersize or oversize, except when the investing room temperature is the same as mouth temperature.

Castings invested at existing room temperature, without control for changes in pattern dimensions, vary in their dimensions just as much as those of Taggart's time. Obviously, any technic which ignores pattern investing temperatures is like the buying of a suit by mail order without stating your size.

WATER-BATH TECHNICS

Figure 2 reveals the manner in which the water bath technics overcome the investing temperature-dimensional variable

of the pattern and thus stabilize casting dimensions.

In the wax phase, it will be noted that the shrinkage of the pattern at room temperatures below mouth temperature is overcome by wax expansion accomplished by reheating the pattern to the stabilizing temperature in the bath. Thus, there remains only the shrinkage of gold for which to compensate.

Before the development of cristobalite made the control method possible, this technic afforded the only means of making consistently accurate castings. The diagram reveals that it is fundamentally sound. Castings obtainable in its practical application bear out this contention.

INVESTMENT EXPANSION CONTROL SYSTEM[4]

The third graph represents the investment expansion control method, which provides delicate dimensional control, though patterns are invested at any prevailing room temperature, in a manner that marks the return to the simple procedure of Taggart.

In this system, expansion control is "built into" cristobalite investment by the use of control powder and the automatic scale. An investment is always provided which compensates not only for the shrinkage of gold, but for the temperature-dimensional changes of the wax pattern at different investing room temperatures as well.

As the investing room temperature falls and the pattern shrinkage increases, an investment is automatically provided with greater expansive properties to compensate for the increased wax shrinkage.

The graph reveals, in the investment phase, that, for every 5 degrees F. drop in investing temperature, an investment is furnished with just enough increased thermal expansion to compensate for the slightly greater wax shrinkage, plus, of course, the shrinkage of gold.

Conversely, the investments delivered for investing at higher temperatures have progressively reduced thermal expansion because there is less pattern shrinkage for which to compensate.

The investment, automatically provided for investing at any given temperature, exactly overcomes the wax dimensional variable of that temperature, and always attains an expansion of 1.25 per cent above cavity dimensions to compensate correctly for the gold shrinkage which follows in the gold phase.

Instead of using a constant investment expansion and a particular pattern stabilizing temperature in a water bath, the control method permits the latitude of investing at prevailing room temperatures, and controls, instead, the expansion properties of the investment itself. The control system accomplishes control in the investment phase, not in the wax phase.

The essential difference between the water bath, or pattern-temperature controlled technics, and the investment control method is this: The water bath technics regulate casting dimensions by controlling the pattern investing temperatures to meet the requirements of an investment with a fixed expansion; the control system regulates the expansion properties of the investment to meet the requirements of the pattern investing temperatures.

To suggest that accurate inlays can be made only by the control method would be absurd. The claim is, rather, that the water bath no longer affords the only route to casting exactitude. The control method makes the nicety of precision and the simplicity and convenience of room temperature investing fully compatible.

4. Phillips, D. W.: Scientifically Correct Inlay Technique, D. Digest, 39:72-81 (Feb.) 1933.

It also eliminates the wax distortion caused by reheating the pattern.[5]

CRISTOBALITE, CONTROL POWDER AND THE AUTOMATIC SCALE

A brief description of the investment materials and the automatic scale employed in the control method should suffice because of more complete presentation in previous articles.

The primary investment employed is cristobalite, which has sufficient expansive properties to meet fully the maximum demands of investing at minimum temperatures of approximately 60 F. It will not be necessary to extoll the excellent properties of this material, especially in its present heat-resisting state. I merely refer you to the reports of the Bureau of Standards previously published in THE JOURNAL.

Present developments have fulfilled the prediction of Taylor, Paffenbarger and Sweeney,[6] who said, concerning cristobalite: "Materials of this type will make it unnecessary to use wax expansion and will go far toward making the inlay casting process easy to carry out satisfactorily."

Two new developments have made the use of this material practical as well as precise.

The inherent expansion properties of cristobalite are controlled to the exact point required for casting nicety by introducing a material called expansion control powder for purposes of differentiation from the primary investment cristobalite. As the amount of control powder is increased, the thermal expansion of cristobalite is reduced and is delicately regulated in eleven definite divisions of expansion from a high point of over 1.3 per cent down to 0.6 per cent plus, to the exact point required for precision, any danger of "overexpansion" thus being eliminated.

The proportionment of these two materials to provide an investment with the correct expansion for investing at the various possible room temperatures is accomplished by the automatic scale.

This little scale is calibrated for every 5 degrees of investing room temperature from 60 to 110 F., and automatically delivers at any temperature weighing notch an investment with the right thermal expansion properties for investing at that particular room temperature.

It also provides automatically the proper amount of materials for one investing operation and delivers it uniformly in the preferred consistency, a heavy painting mix.

PRACTICAL PROCEDURE

The automatic scale permits correct preparation of materials ready for spatulation in less than sixty seconds by the clock. The procedure is completely standardized from the time the spatula enters the mix until the casting is removed from the investment.

When using the control method, one merely invests the pattern at prevailing room temperature in a dampened asbestos-lined ring with a single mix of investment and gives it no further attention until the time for burning out. After a twenty-five to thirty minute set, the mold is burned out to red sprue-hole heat, about 1350 F., and cast immediately. This represents a procedure even more simple and practical than is employed in so many uncontrolled technics.

It should be kept in mind that a red ring does not necessarily indicate the rec-

5. Maves, T. W.: Distortions of All Wax Patterns When Heat Is Applied, J.A.D.A., 19:606 (April) 1932.

6. Taylor, N. O.: Paffenbarger, G. C., and Sweeney, W. T.: Dental Inlay Casting Investments, Physical Properties and Specification, J.A.D.A., 17:2266-2282 (Dec.) 1930.

ommended red-heat mold. The color of the sprue hole is the gage of mold casting temperatures.

Elimination more rapid than has been generally employed heretofore is possible in the control system because of the high heat-resisting properties of the investment materials employed.

EXPANSION VARIATION FOR DIFFERENT TYPES OF PATTERNS[7]

Castings have been accepted as "precision" if compensatory expansion correct in current theory was afforded, even though the same fixed expansion was uniformly provided regardless of pattern type. Practical and experimental results of actual casting demonstrate the fallacy of this conception.

Expansion variation for different types of patterns has added nicety indeed to the practical interpretation of casting accuracy. This has been an important precision requirement recognized by the expansion control method since its introduction. The recent incorporation of this principle into other technics attests its efficiency.

Countless tests have dictated that more than average investment expansion be employed to secure correct adaptation for full molar crowns, all one-surface castings and large mesioclusodistal molar castings. Three-quarter crowns for anterior teeth require "underexpansion" for a comparable fit.

The principle of expansion variation was worked out and applied practically for several years while the water-bath technic was employed. I found it most convenient to accomplish this variation by adjusting the bath temperatures to above or below the average stabilizing temperature employed. This increased or decreased the wax expansion to above or below that provided at the regular stabilizing temperature, and obviated variation of the mix consistency.

The data thus accumulated were applied in the development of the control system, which was particularly adapted to delicate control in a new and simple manner.

In the latter method, expansion variation is easily accomplished without any alteration in the procedure from the time the investment is spatulated, and without any change in the consistency of the mix.

The automatic scale, when it is used in the regular way, provides investments which meet average expansion requirements for the investing temperatures prevailing. To obtain greater expansion, one merely balances the automatic scale on temperature graduations below the existing room temperature. This is inscribed on the scale. Thus, if the room temperature is 80 F., investments weighed on the 75, 70, or 65 degree graduations would progressively afford greater expansion. Automatically, this increases the proportion of cristobalite. For less than average expansion, scale temperature graduations above the prevailing room temperature are similarly used. This increases the proportion of control powder.

A 5 degree variation effects a slight variation in expansion and a 25 degree change produces a large variation. The simple standardized investing, burning and casting procedure is, of course, uniformly employed at all times. Not one extra second of time or attention is required.

Now that the efficacy of this principle is being increasingly recognized, research workers are directing their attention to an explanation of it all. Numerous experiments, which I cannot cite for lack of time, indicate that there are at least three reasons for expansion variation: (1)

7. Footnotes 3 and 4.

the fluctuating value of the "effective" setting expansion, dependent on pattern type; (2) the diverse "effective" shrinkage values of congealing metal, contingent on pattern mold shape, owing to the presence, extent and relative position of investment interposed between parts of its shrinking mass; the simple occlusal casting requiring more "expansion" because it is free to shrink unrestrained; (3) similar variable shrinkage values, but occurring in the wax pattern. A very slight flow occurs in the wax about interposed tooth structure as it cools and shrinks to its critical or hardening temperature.

The last two explanations are submitted because variation results when an investment with reduced setting expansion is employed.

THE ANSWERS

Manifestly, any criticism must be answered, if only in a defensive manner without countercriticism. Recently, an essayist[8] devoted a large part of a paper to what he considered the disadvantages of the control system. This worker, an ardent advocate of the water immersion bath, particularly opposed the idea of investing patterns at room temperature.

He expressed concern that the exactitude of room-temperature investing might be impaired by the possibility that the temperature might vary in different parts of the room. He said: "It is not easy to find the room temperature." We have found a thermometer quite effective. Obviously, it is placed at the bench where investing is performed. Experience indicates that it is easier to maintain room temperature stability than it is to keep a constant temperature in a water bath which is not delicately controlled with a thermostat.

He also said that mixes made at room temperature cool from 5 to as much as 20 degrees F. because of evaporation. Tests of others indicate that about one tenth of the latter figure represents a more faithful recording of facts.

Any one can easily check the comparative veracity of these two conflicting statements by merely investing the bulb of his x-ray developing thermometer in a mix made of room-temperature water and investment and taking the readings on the protruding graduations.

It is interesting to note that the heat evolved by the chemical reaction of the setting investment is sufficient to offset the temperature reduction due to evaporation. Furthermore, it should also be kept in mind that we are concerned particularly with the temperature of the pattern and the surrounding investment at the time investment set materializes about the pattern, in any technic. That is why water bath investments are retarded sufficiently to permit the warmth of the water in the bath to be conducted through the investment to the pattern before the investment sets. Otherwise, the wax expansion, which obviously must take place in the water bath technic when the pattern temperature is raised from ordinary room temperature to the higher stabilizing temperature, could not be utilized to assist investment expansion in balancing shrinkages.

It was also claimed that it was possible to produce weighing errors by piling the investment on one side of the cup of the automatic scale. Special training will probably not be necessary to learn to place the investment evenly in the cup.

The essayist criticized the regulation of the water-powder ratio in the control system. A thorough reading of the specification [6] of the Bureau of Standards pro-

8. Coy, H. D.: Review of Inlay Casting Technics. Read at the Midwinter Clinic of the Chicago Dental Society, Feb. 27, 1934.

vides the strongest answer to this criticism. Careful analysis of the specification uncovers the faithful adherence of the control method to its every detail. The specification provided the correct basis for this investigative work and the invaluable data reported by those of the bureau made this development possible.

There is a delicate distinction between the academic term water-powder ratio and the phrase so significant in its practical as well as its theoretical application, mix consistency. They are not strictly synonymous nor reciprocal terms. The ratio is an abstract figure; consistency is a concrete property of a mix.

It will be noted that the specification scrupulously avoids the recommendation of a definite water-powder ratio because different investments vary in their aqueous requirements to produce a consistency standard. A very specific "testing consistency" is prescribed in the slump test.

The expansion control method actually provides eleven different investments, each with a different thermal expansion and obviously of slightly different composition. Taylor, Paffenbarger and Sweeney,[6] in the article preceding the published specification, say: "The water-powder ratio varies for different investments. The heaviest painting consistency is preferred." In the control method, this preferred consistency is automatically provided at all times for investing under all conditions. The same quantity of water is always used and the water-powder ratio is always correctly adjusted in strict accordance with the recommended consistency. Furthermore, every mix delivered by the automatic scale is of the "testing consistency" defined in the specification of the Bureau of Standards.

It is particularly desirable to maintain the preferred working consistency. Thinning the mix weakens the investment and reduces the smoothness of castings; thickening the mix beyond the testing consistency increases investing difficulties.

In fairness to our critic, it should be stated that he described the control method as one of the "better methods" and recommended its use.

Dentists, of all people, know how difficult it is to satisfy everyone. Another speaker recently stated that the unusual accuracy of the control method was not necessary; that instead of having eleven investments of different thermal expansion out of only two cans, three or four of the investment admixtures could be used. In other words, the control principle of adapting the investment to the conditions obtaining would be applied, but only loosely, so that its exactitude would be impaired. I agree that the method could be changed slightly so that less accurate casting could be accomplished just as easily. It would be just as logical and fitting if the collars that we wear were available in only three sizes.

The same idea was used in the earlier stages of the expansion control development, but was discarded because I recognized that it rendered the process vulnerable to the just criticism of inaccuracy. Thus far, I have been unable to make any inlays which I considered too exact. Surely after the time and effort spent to prepare cavities correctly and to secure exact wax impressions, it is worth a fraction of one minute to do full justice to these hard-earned patterns.

IMPORTANCE OF ACTUAL RESULTS IN CASTING

We who appear as essayists are usually expert in the art of hypothetical casting. Illusional inlays cast in the delivery of a paper are vocalized to a superlative state of precision. This is all accomplished "with the greatest of ease"—if performed by the author's technic.

But it is more difficult to cast than to broadcast. After all, the only thing that actually counts in casting is the tangible results of actual casting. Theoretical calculations, charts, curves and data are mere pseudoscientific piffle if they cannot be sustained by practical casting operations.

The two paramount questions are: "What kind of practical castings can the great majority obtain with a technic?" and "Is it sufficiently quick and simple that they will use it?"

REFINEMENTS

Some refinements of the figures and weights cited in the original presentation[4] of the control method a year and a half ago have since been incorporated into the automatic scale and the materials. The thermal expansion curves of the investments now used for each 5 degrees F. change in investing temperatures are illustrated in Figure 4. These curves flatten out when they enter the mold casting-temperature range, indicated by the heavy lines between 1100 and 1500 F. This affords an unusually broad casting range of almost 400 degrees. In this casting-temperature range, the thermal expansions of the various investments increase regularly and progressively, one over the other, as the investing temperatures fall, and automatically compensate for the increased pattern shrinkage of lowered investing temperatures.

MECHANICAL INVESTING[9]

In contrast with the volumes written concerning casting to dimensions, another precision requirement, and of equal importance, smooth surfaces, has been somewhat underemphasized. The presence of tiny nodules or "bubbles" on inlays impairs their accuracy of fit just as effectively as failure to cast to exact cavity dimensions.

The automatic investing machine was developed to obviate this difficulty. It proved very useful in the investigative work from which the control method was evolved because of the necessity of registering delicate nodule-free recordings of fit, and because of its ability to invest several patterns in the same ring as easily and quickly as one.

From two to four patterns were always invested for each expansion check, and four patterns, two each of different types, were systematically employed in comparative tests for the expansion variation required for different types of castings. Incidentally, when several patterns are invested simultaneously, much time is saved in both the investing and the casting operations and in investment materials as well. Furthermore, mechanical investing permits delegation of this work to assistants.

Incidental to the machine, a convenient rubber end cap was devised which can be quickly snapped on or off the end of the ring; also a new multiple type crucible former to facilitate the investing of several patterns at one time.

Over thirty patterns have been invested in seventy seconds and cast simultaneously to demonstrate the efficacy of the automatic investing principle. In practical work, we have found that surface imperfections have practically ceased to be a factor.

CRITICAL TEMPERATURE THEORY

In a paper[10] read before the Cleveland Dental Society, in January, 1934, I presented an inlay theory called the "Critical Temperature Theory." The critical temperature of an inlay wax was defined as

9. Phillips, D. W.: Automatic Investing Machine, D. Digest, 38:122-128 (April) 1932.

10. Unpublished data.

the temperature at which wax hardens and assumes the quality of elasticity as flow properties are reduced.

This temperature was recommended as approaching the zero point for wax dimensional calculations more closely and constantly than the temperature at which the pattern was adapted. The true zero point was placed between the two figures subject to some variation dependent on manipulation temperature differentials and pattern type. The theory further emphasizes the diabolical characteristics of inlay wax.

It renders more lucid the fact that patterns adapted to the same cavity, whether at mouth temperature or at ordinary room temperature, represent similar degrees of fit when invested and cast under identical conditions.

But when the direct method is used in inlay work, currently accepted theory and the critical temperature theory are at only slight variance, because wax, by virtue of its very requirements, hardens at temperatures just above mouth temperature.

For this reason, and to avoid confusion of thought, the diagrams which have been presented have been explained in accordance with current theory.

CONCLUSION

The control system is exact despite climatic or geographic variation. As the only room-temperature investing method which compensates accurately for the dimensional changes of wax patterns at different investing temperatures, it is the only room-temperature precision technic.

Both this temperature-dimensional variation of the pattern and expansion variation for different types of patterns are accorded the recognition that they merit in our quest for accuracy in casting, and these significant variables are assuming their rightful place of importance with the well-known gold or casting metal shrinkage.

The control principle of making the inherent investment expansion meet the investing conditions is the logical one and is more direct than making the investing conditions conform to the requirements of an investment. Now we control the investment horse, harnessed and properly placed before the casting cart. But, in addition to unusual exactitude, the control method has the particular advantages of convenience and simplicity. It requires even less time and attention than many of the haphazard technics which are still being recommended and which utterly disregard pattern investing temperatures.

It is the short route to casting exactitude for those who wish to achieve nicety in this work in the quickest, easiest and most certain manner.

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CONTROLLED HYGROSCOPIC EXPANSION OF INVESTMENT TO COMPENSATE FOR SHRINKAGE IN INLAY CASTING*

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HYGROSCOPIC expansion of investment may be defined as the increased setting expansion obtained when moisture comes in contact with investment while setting. This physical property of investment was unknown at the time the physical properties of investments were reported to the Research Commission of the American Dental Association.[1] Consequently, when the specifications for dental casting investments and the technics for their use were formulated, no consideration was given to the influences hygroscopic expansion may produce in an investment or casting technic.

The chief aim in presenting a paper on this subject is to give the general practitioner information that will enable him to produce castings of the highest degree of accuracy with the equipment usually found in a dental office. Evidence will be presented that hygroscopic expansion affects the results obtained in nearly all technics in use at the present time. This evidence is that hygroscopic expansion may produce errors as great as casting shrinkage in technics that otherwise might be considered satisfactory. In contrast to these errors, it will be shown that hygroscopic expansion can be controlled to such a degree of accuracy that a difference in shrinkage of different gold alloys can be demonstrated.

To show how hygroscopic expansion produces errors in a casting technic, the original technic recommended for cristobalite investment has been selected. This was done because it is universally known and the conditions arising are readily demonstrated. The remarks are also applicable to the variation of this technic developed by David W. Phillips, known as controlled expansion, and many other technics.

The following experiment is presented: Three molds are made with 1 inch precision gage blocks so that the setting and hygroscopic expansion of the investment can be accurately measured under conditions similar to those found in casting technics. In the first mold, the blocks are placed on a glass slab; in the second mold, the blocks are placed on a sheet of dry asbestos, and in the third mold, the blocks are placed on a sheet of wet asbestos. A mix of cristobalite investment is made and a portion of this mix is placed in each mold and allowed to set for at least thirty minutes as recommended by the manufacturer of this investment. In measuring the three specimens after they have set thirty minutes, it will be noted that

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

1. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Dental Inlay Casting Investments: Physical Properties and a Specification, J.A.D.A., 17:2266 (Dec.) 1930.

the one made on the glass slab has expanded approximately 0.1 per cent; the one on the dry asbestos, from 0.3 to 0.4 per cent, and the one on the wet asbestos, from 0.6 to 0.9 per cent. At the end of an hour, the one on the glass slab has expanded approximately 0.25 per cent; the one on the dry asbestos, from 0.5 to 0.8 per cent, and the one on the wet asbestos, from 1 to 1.3 per cent. The increased expansion taking place on the wet asbestos is hygroscopic expansion. The increased expansion taking place on the dry asbestos is explained by the fact that the asbestos takes up moisture from the investment, which produces a denser mix and then allows moisture to reenter the investment, hygroscopic expansion resulting.

This experiment shows that the simple procedure of lining an inlay ring with either wet or dry asbestos produces hygroscopic expansion. When a wet liner is used, the error may be as great as casting shrinkage. These figures will vary in different investments, but volumetric changes as great as these are worthy of cognizance and study.

By applying these figures to this technic, it can readily be seen that our results are further affected in the manner of placing the asbestos liner in the ring. Should the asbestos liner be placed loosely in the ring, the expansion will be in every direction, and the use of the metal ring will not affect the thermal expansion of the investment. When the asbestos liner is placed tightly in the ring, the setting and hygroscopic expansion is limited by the walls of the ring and the investment expands toward the ends of the ring.

The thermal expansion of the investment is influenced by the use of the metal ring in the same manner. C. S. Van Horn[2] showed that a brass inlay ring expanded 0.6 per cent, while cristobalite investment expanded 1.25 per cent at 572 F. This difference in expansion is responsible for warpage in the mold unless a loose asbestos liner is used. There is no sound reason for using a tightly fitting asbestos liner, unless it is to insulate the investment from cooling.

Hygroscopic expansion is responsible for another variable in technics of this type in that some of the expansion is lost by the resistance of the wax pattern. This loss is marked in full crown and large mesioclusodistal patterns and practically nonexisting in three-quarter crowns or a small one and two surface patterns. David W. Phillips makes corrections for this variable in his technic with control powder, but does not attribute the variable to hygroscopic expansion.

From the figures quoted, it can be seen that technics for cristobalite investment can be greatly improved by the simple expedient of using a loosely fitting dry asbestos liner in the inlay ring. It is also possible for the manufacturer to eliminate hygroscopic expansion from the material.

Time does not permit an explanation regarding the influences hygroscopic expansion has on the many types of technics in use, but a few will be mentioned. In the wax expansion technic of Dr. Van Horn, 0.7 per cent hygroscopic expansion is obtained, all of which is available owing to the split type of holder that he uses, and the warm water eliminates any resistance from the wax pattern. Technics using a dense core and double mix technics have hygroscopic expansion, the moisture being furnished by the outer investment.

In the technic of Herbert D. Coy, setting and hygroscopic expansion is practically eliminated, because he confines the investment in the ring with covers held

2. Van Horn, C. S.: D. Cosmos, 76:5-11 (May) 1934.

in place with a clamp. The elimination of hygroscopic expansion from Dr. Coy's technic enables one to obtain excellent results with a technic that has been criticized because of the wax expansion used.

From the information at hand, it becomes apparent that we have two alternatives: (1) the elimination of hygroscopic expansion from technics where it is not desired and (2) the utilization of controlled hygroscopic expansion to compensate for wax and casting shrinkage.

The standardization of an investment for hygroscopic expansion gave us methods that will satisfy every condition arising in inlay casting. For the man who demands the greatest accuracy in his casting technic, there is a technic that is accurate to 0.1 per cent. For the man who demands simplicity and speed, there is a technic that is no more complicated than William H. Taggart's technic, yet for all average castings its accuracy is such that no error is detected.

The simple technic consists of loosely lining an inlay ring with a piece of wet asbestos long enough to extend one and one-half times around the ring, to allow for the expansion of the investment. The investment is mixed to the consistency of soft putty. The pattern is invested in the wet asbestos lined ring and allowed to set at least thirty minutes. The case may be left standing indefinitely without deleterious effects. For inlays, three quarter crowns, etc., the temperature of elimination should not be over 800 F. In the absence of controlled heat, it is best to cast shortly after the case has stopped smoking. For full crowns, casting is done at a dull red temperature. In this technic, no consideration is given to wax shrinkage or difference in gold shrinkage. The water in the asbestos ring produces sufficient hygroscopic expansion to compensate for average casting shrinkage when it is not influenced by the presence of the wax pattern. In full crowns, some thermal expansion of the investment is required owing to the influence the presence of the wax pattern has on hygroscopic expansion.

For the man who wishes to control his casting technic for wax shrinkage and difference in gold shrinkage, the amount of hygroscopic expansion desired is controlled by time. This is accomplished by the fact that the available hygroscopic expansion diminishes the longer the investment is permitted to set before moisture comes in contact with it. There is a single and a double mix technic recommended to assure these results. The single mix technic for all practical purposes meets every condition necessary for inlay casting. The double mix technic can be controlled to an accuracy seldom required in dentistry. It is recommended for casting fixed bridges in one piece and other precision castings.

The single mix technic consists of loosely lining the ring with a piece of dry asbestos long enough to extend one and one-half times around the ring, to allow for the expansion of the investment. The pattern is invested in the usual manner and allowed to set.

The investment in the inlay ring is expanded by immersion in water the temperature of which is from 105 to 110 F. The water is used at this temperature to eliminate any effect the wax pattern might have on the expansion. A constant temperature bath is not required, a dish that will hold a quart of water being all that is necessary.

The amount of expansion is controlled by the time the investment is allowed to set before it is immersed in the water. For average expansion at room temperature of from 68 to 75 F., the case is immersed after it has set fifteen minutes. The expansion may be increased by immersing

the case before it has set fifteen minutes, or the expansion may be reduced by allowing the case to set longer than fifteen minutes. The difference in the expansion obtained is 0.1 per cent per minute for several minutes either side of the average fifteen minutes of setting time.

The case is permitted to remain in the water not less than twenty nor more than thirty minutes.

There will be less than 0.2 per cent change in the size of the mold if eliminated under 800 F. In the absence of controlled heat, it is best to cast shortly after the case has stopped smoking.

In the double mix technic, the slight expansion taking place in the single mix before the case is immersed, due to the dry asbestos lining in the ring, is corrected. In this technic, the pattern is invested in a waxed paper ring and allowed to set the required time. The waxed paper is removed and the case immersed as in the single mix technic. The case is then invested in an inlay ring and the wax eliminated as in the single mix technic.

Any method of casting that will give satisfactory results may be used.

SUMMARY

1. Hygroscopic expansion may produce volumetric changes as great as 3 per cent in suitable investments.

2. A physical property of investments capable of such marked volumetric changes must be considered in formulating specifications for investments and the technics for their use.

3. Hygroscopic expansion can be controlled to the highest degree of accuracy by a very simple technic with the equipment usually found in dental offices.

4. Accurate molds made by hygroscopic expansion are not distorted by the action of other physical properties of the investment in this casting technic.

5. The powder: water ratio in hygroscopic expansion is no more critical than in other types of expansion.

6. There is less than 0.2 per cent change in the mold during the burning out process and subsequent cooling shrinkage is reduced.

7. The surface finish of the castings is exceedingly smooth.

8. The accuracy of the mold can be controlled to such a degree that the difference in shrinkage of different gold alloys is demonstrated.

9. Hygroscopic expansion may be modified for the purpose of making larger castings.

CONCLUSION

Since hygroscopic expansion of investment effects the results obtained in casting technics to a large extent, it seems logical that controlled hygroscopic expansion of investment should be a method of choice in making expanded casting molds.

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SPHERICAL OCCLUSION: A LOGICAL DEDUCTION*

By C. W. BENSON, D.D.S., Duluth, Minn.

THE "theory of spherical occlusion," by its very title, suggests geometry. That being the case, it can best be discussed in the terms common to that subject. Spherical occlusion is based on mandibular movement; that it to say, the mandible and its teeth in motion, and therefore must be considered under the subject of "descriptive geometry." It may be well to quote from a textbook on "Descriptive Geometry" those paragraphs dealing with the few principles involved in the subject of spherical occlusion.

The author of the book writes:

A point is said to revolve about a straight line as an axis when it describes the circumference of a circle whose center is in the axis, and whose plane is perpendicular to the axis. When all the points of any geometrical magnitude move in this manner, without change of relative position, and therefore with the same angular velocity, the whole magnitude is said to revolve about a straight line as an axis.

"Descriptive Geometry" also says:

A surface of revolution is one which may be generated by the revolution of a given line about a straight line as an axis.

Single curved surfaces of revolution are of three varieties, viz.:

1. Cones.—In which all of the rectilinear elements intersect in a common point.
2. Cylinders.—In which all of the rectilinear elements are parallel.
3. Convolutes.

The last does not concern us in this paper.

"Descriptive Geometry" also states that "every surface may be generated by the motion of a line" and that "this moving line is called the generatrix and its different positions are called elements of the surface." Further, it is stated that "a plane traversing the axis is called a meridian plane, and its intersection with the surface is called a meridian line," and that "in generating a cone, the straight line moves so as always to touch a given curve called the directrix and also traverses a given point called the vertex."

The available evidence to any concept of mandibular movement is at best very meager, and demands the closest scrutiny. Such evidence must, of course, be obtained when the mandible is in a captive state, in wax checkbites. Unlike the study of the movement of a heavenly body, which can be resumed on successive nights, the mandible is subject to such a wide variety of movements within the fraction of a minute that arrival at a definite conclusion becomes a most confusing task.

The instrument which the late George S. Monson designed was primarily constructed for the purpose of proving, if possible, the correctness of his theory of spherical occlusion. It was in reality a physical laboratory instrument. Incidentally, this instrument with a few minor additions became the Monson articulating instrument.

I wish to stress the point that Dr.

*Read before the Section on Full Denture Prosthesis at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

Monson should be remembered for his achievement in the study of mandibular movement, culminating in his theory of spherical occlusion, and not as a creator of an articulating instrument as a commercial possibility.

It is but natural that I should use his articulating instrument in my work on this subject, since it is the only instrument by means of which his theory can be demonstrated. As pointed out in my former paper, on "Condylar Guidance," the action of planes of orientation points unmistakably to the correctness of the spherical theory. The planes of orientation act as secant planes intersecting surfaces of revolution, from their horizontal position in centric occlusion of the teeth

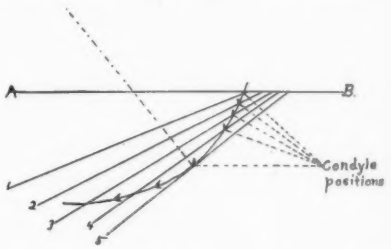


Fig. 1.—Condyle positions. *A-B*, transverse axis. The secants *1, 2, 3* and *4*, and the tangent line *5* all lie on the plane of orientation, for respective positions of the left condyle. As the condyle moves along the curve, an increase occurs in the angle of the plane. Therefore, any position of a plane of orientation represents a definite position of that condyle, and no other position of the condyle.

to their position in extreme range when they become tangent planes to surfaces of revolution.

"Descriptive Geometry" states that "a plane tangent to a surface of revolution is perpendicular to the meridian plane through the point of contact." You are at liberty to investigate the application of this truth to the positions of planes of orientation in cusp relations of extreme ranges. From ocular inspection, there seems to be no question as to the application of this truth to guide planes adapted to wax bite records of cusp relation. For many years, we have pinned our faith, as concerns cusp relations, to the adaptable feature of planes of orientation, to learn that any position assumed by a plane of orientation represents a snapshot picture of a definite position on the Monson curve. To me, this is sufficient proof of the correctness of the Monson theory.

Figure 1 illustrates the condyle point moving along the Monson curve, forcing

Fig. 2.—*OAB*, triangle which maintains constant relation to mandible and teeth throughout all movements.

the secant line downward. It is evident that any position of a plane of orientation represents but one specific position of that condyle.

Figure 2 shows the Monson instrument in part. The triangle *OAB* shown remains constant in form as well as in its relation to the lower cast. Knowing this, we can, by means of the triangle, analyze any movement of the mandible. It has been said that analysis of condyle movements does not give evidence of di-

rection of movement of the rest of the mandible.

This triangle, in its constant relation to every mandibular tooth, and every part of the remainder of the mandible offers positive evidence of what the remainder of the mandible is doing when in motion. "Descriptive Geometry" states that "when all the points of any geometrical magnitude move in this manner without change of relative position and therefore with the same angular velocity, the whole magnitude is said to revolve about a straight line as an axis." You may visualize a three dimensional figure formed by

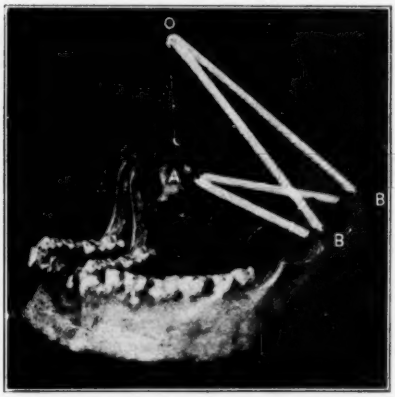


Fig. 3.—*OA*, axis produced when point *B* moved to *B'*, on which every point of mandible and teeth moved.

the triangle shown and another line from the top vertex of this triangle to the median incisal point of the mandibular teeth, a spherical pyramid, if you please, this entire geometrical magnitude revolving on the leg *OA* of the triangle; or you may visualize every tooth cusp revolving on the axis *OA*. The mental picture is the same. We know that if a condyle revolves on *OA* as an axis, every point of the mandible likewise revolves on the line passing through the points *O* and *A*, as an axis, in the right lateral movement. (Fig. 3.)

Figure 4 shows the assembled instrument with the casts in centric relation. Besides the triangle, two other lines have been added. They extend from the top point of the instrument, terminating in the transverse axis, one on each side in points coincident with the condyle points in this position, which provides a means of showing the extent of movement of a condyle.

Figure 5 shows a right lateral wax bite in position between the upper and lower

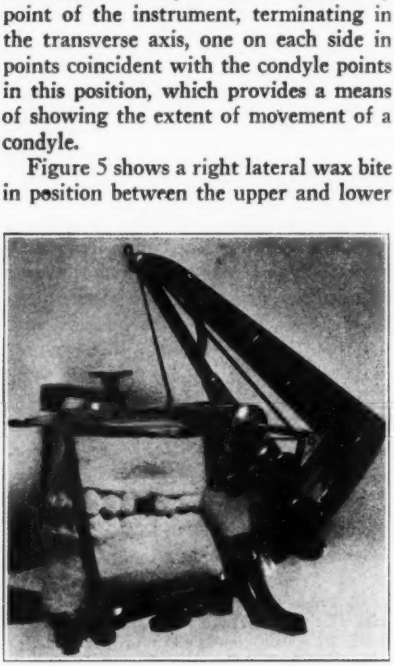


Fig. 4.—*OA*, two coincident lines; *OB*, same.

teeth. The extent of movement of the left condyle may be noted.

Figure 6 shows the right side, where the right condyle remained in the transverse axis. Point *B* of the triangle moved away from the transverse axis. Point *A* remained in the transverse axis. Point *O* at all times remains in one and the same plane, which is perpendicular to the opening axis. Then there is only one possible way in which point *B* could move forward, and that is on *OA* as an axis. Try

this for yourselves, for on this fact is based the theme of this paper. Hold a leg of a rigid triangle in your left hand in a certain constant position, while with your right hand you move the opposite vertex toward you. You will find that if the movement is continued, it will carry the vertex in your right hand entirely around the leg held in your left hand. Point *B* will describe a circle lying in a plane perpendicular to the axis held by the left hand. (Fig. 7.)

The intercondylar dimension, or base of the triangle, acts as the generatrix,

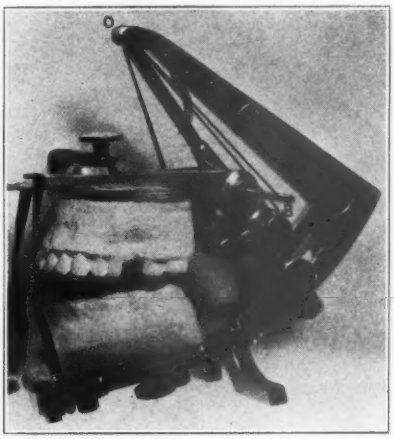


Fig. 5.—Case showing that leg *OB* of triangle has moved, point *B* moving forward and downward and to right. No change is shown in the position of *OA*.

forming a cone of revolution with its vertex in the right condyle and its base the area circumscribed by the circumference of the circle in which the left condyle, or point *B*, moves. (Fig. 8.) This circle would be the directrix of a cone of revolution. Of course, the intercondylar dimension does not describe a complete cone because the left condyle does not traverse the entire circumference of the circle, or directrix; but, from the nature of its movement, it does describe a segment of the surface of such a cone, under conditions shown in Figures 5 and 6. There is no other possible course for point *B* relative to the axis *OA*.

For the sake of simplicity, we shall consider the movements of the condyle points with respect to their axes before we consider the influence of the opening component.

Figure 9 shows a left lateral wax bite in position and the resultant movement. Here, the right condyle revolves on *OB* as its axis, and the intercondylar dimension (generatrix) describes another cone

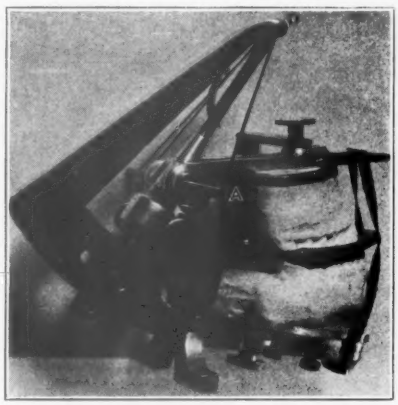


Fig. 6.—Right side of instrument, casts and bitewax shown in Figure 5.

of revolution whose vertex lies in the left condyle.

Figure 10 shows the protrusion movement as recorded in a wax checkbite. Please note that I said movement, not relation, for I know from the nature of the design of the instrument that the condyle points must have moved in arcs of circles on an axis passing through the top point of the instrument. This axis of protrusion movement is parallel to the opening, or transverse axis. When we know the action of the instrument, we know that

the condyle points could move in no other manner, and yet this form of movement will check any protrusion bite relation.

In these various movements of the triangle, the intercondylar dimension may be considered the generatrix of two right circular cones of revolution and a cylinder of revolution, that is, imaginary surfaces formed by continuous movements of the line *AB*. A right circular cone is one in which the axis passes through the vertex and the center of the circular base, making equal angles with the elements of the surface. The intercondylar dimension is, at the same time, a rectilinear element and generatrix of a cone produced by right lateral movement of the mandible, another cone produced by left lateral movement of the mandible and a cylinder of revolution produced by the protrusive movement. (Fig. 11.) The cones of revolution have their vertices in the center points of the condyles, and, in each case, a condyle lies in the circumference of the base of a cone of which the opposite condyle is the vertex. Since the intercondylar dimension is a common rectilinear element of these cones and the cylinder, and the axes of movement of these three geometric forms are radii of the sphere of occlusion, all passing through the vertex of the triangle, the vertex lying in the center of the sphere of occlusion, the entire geometric scheme of movement is harmonious with the sphere.

Figure 12 shows the sphere on the surface of which is indicated the four circles in whose circumferences the condyles travel at various times. They are the directrices of the cones and cylinder of revolution. This geometric relation between condyles and axes of movement holds true when there has been no retrusive movement of a condyle on the axial side, which is unnecessary, and owing to muscle strain, a freak movement. Even such a

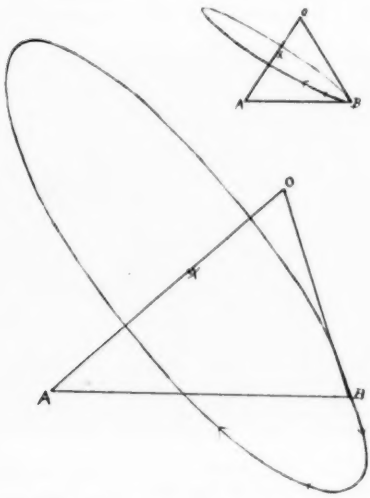


Fig. 7.—Above, triangle as it looks on plane of paper. Below, triangle lying in plane inclined toward foreground and to right.

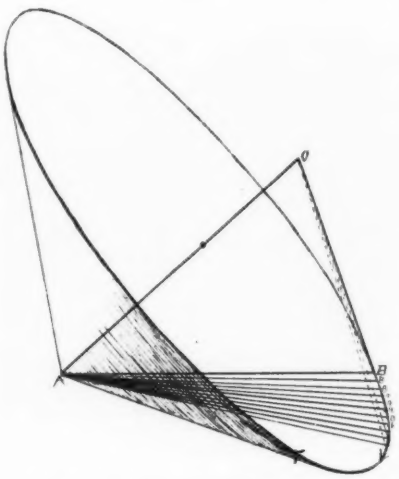


Fig. 8.—Lines radiating from *A*, below line *AB*, representing successive positions of intercondylar dimension. These are elements of the cone of revolution.

movement is compatible with the spherical theory, only that when such a relation is recorded, the radial axis of movement does not pass through a condyle. The axis then passes through a point inwardly from the retrusive condyle. As pointed out in a former paper, such movement need not be tolerated by the dentist. The same patient who recorded right and left bite relations whose axes passed through the condyles accidentally recorded just one relation showing a retrusive condyle, due to his straining the muscles in trying to reach a greater range to the left.

Fig. 9.—Lines indicating that leg *OA* of triangle has left transverse axis to accommodate left lateral bitewax. There is no change in the line *OB*.

Now, I shall take up the question of the effect of opening. As stated in a former paper, whether the components of a bite record are made simultaneously or successively does not matter in the final record. There will be a certain value of each in the final wax record irrespective of how fast the mouth opened or how quickly or slowly the lateral or protrusion movement was made. Therefore, we may well analyze the opening movement by itself.

The effect of the opening movement, or component of a bite, is simply to tip the entire sphere forward and downward on the transverse axis.

Figure 13 shows the mandible and sphere in centric position.

Figure 14 shows the mandible and sphere in the position of an increased vertical dimension.

Since the top point of the triangle represents the center of the sphere of occlusion, it follows that when opening tips

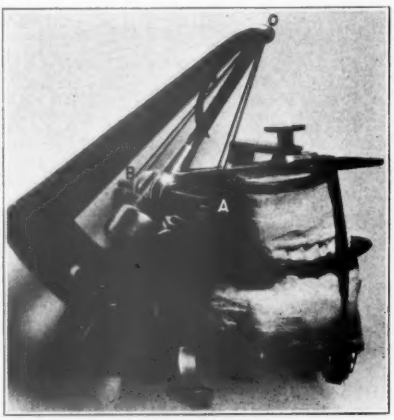


Fig. 10.—Effect of protrusion bite. Both *A* and *B* have left the transverse axis.

the sphere on the opening axis, the center moves to a new position, carrying the axes of lateral and protrusion movements along with it, a greater declination of the condyle tracing resulting. This action is more fully explained in a former paper published in THE JOURNAL.[1]

While the circles of revolution of the condyles on their axes remain constant to their respective axes, opening carries the

1. Benson, C. W.: Condylar Guidance, J.A.D.A., 19:1591 (Sept.) 1932.

entire process to a new location. It is like moving a three-ringed circus to another town. Every piece of apparatus within the tent occupies the same relative position as before irrespective of the fact that the entire tent and its contents have been moved to a neighboring city.

Incidentally, the question of high cusps, low cusps, no cusps or inverted cusps is merely a matter of different values of opening components. Of course, cuspless teeth, or inverted cusp teeth, impose no additional opening. They have no bearing on the nature of the mandibular movement, which remains spherical. We have in the past allowed ourselves to be confused by this question of cusp influence in determining mandibular movement. Cusps merely impose a degree of opening to allow for cusp escapement. Such opening, however slight, causes the sphere of occlusion to tip forward the same number of degrees as the imposed opening. Opening, and tipping of the sphere, take place on the same axis, the opening axis. When thinking or speaking of spherical occlusion, this opening movement should be considered as a thing apart from the subject; otherwise, it leads to the very intricacies so often mentioned by authors in speaking of mandibular movement. Cusps are not the impelling force which determines the nature of mandibular movement; muscles determine that, and the movement is spherical in whatever degree of vertical dimension.

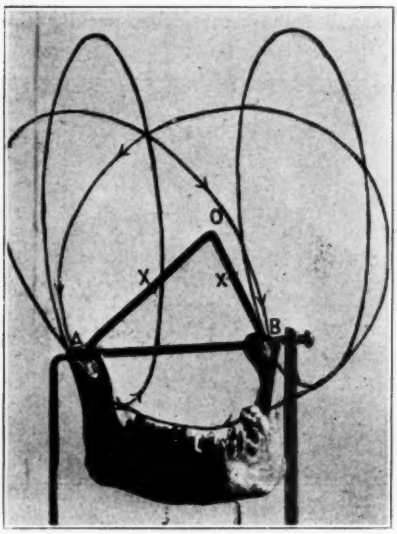


Fig. 11.—Circles representing bases of right and left cones of revolution and cylinder of revolution.

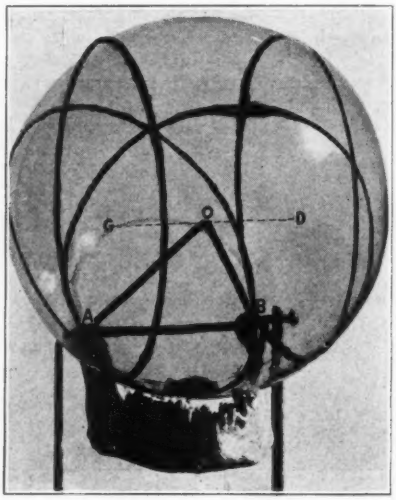


Fig. 12.—Sphere of occlusion. The line *CD* indicates the axis of the protrusion movements, while *OA* is the axis of right lateral movement and *OB* the axis of left lateral movement. The circles lie in planes which are perpendicular to their respective axes.

If we were walking the deck of a steamer in a continuous course around the bow, to the stern and back on the other side, for several laps, we would consider our course unchanged as far as the steamer was concerned, although the

steamer may have sharply changed its course in the meantime. I trust that I may convey to you the thought that the sphere of occlusion represents lateral and protrusive movements and that opening the bite transports these spherical movements, along with the sphere, to a new position in space. Opening alters the relation of the spherical surface to the maxillary teeth. Therefore, a spherical surface reconstructed to an increased vertical dimension cannot be concentric with any balanced occlusal guide survey made at the time of mounting the casts. Lateral and protrusive movements, while construction is in progress, demand that the articulating instrument be so designed that it automatically provides for this new position of the center of the sphere. Otherwise, mandibular movement cannot be reproduced on the instrument, and spot grinding and milling cannot be accomplished in accord with mandibular movement.

Since the maxilla and its teeth may be considered static as far as movement of the mandible is concerned, it is evident that when the opening movement carries the sphere of occlusion to a new center, condyle traces on the surface of the sphere will be of a greater angular magnitude with respect to the upper teeth than they were before, with the result that tangents to these curves will likewise show a greater degree of declination than they did for a bite of lesser vertical dimension. The action of the adaptable articulating instrument confirms this. If, as contended by some in the profession, the center of muscular balance, or occlusal

Fig. 13.—Position of sphere of occlusion and mandible in original position of centric occlusion. The arcs indicated by the arrows would form the condyle traces in protrusive movement of the mandible for this vertical dimension, or opening component.

Fig. 14.—Double exposure showing effect of opening to greater vertical dimension. The center *O* has moved to *O'* and the condyle traces for a protrusive movement have moved from *1* to *2*, indicated by arrows. The numerals shown in white call attention to the extent of the opening, which is of the same number of degrees as that shown by *O* and *O'*.

curvature, did not move, the radius from the center to the median point of the lower teeth would be greater than the radius from the center to the molar teeth when the bite is opened, with the result that, during the protrusive movement, for instance, the lower anterior teeth would traverse a curvature of greater radius than would the posterior teeth. Such a condition is unthinkable. Since the axis of protrusion movement passes through the center of occlusal curvature, if the center of curvature did not move, occlusal curvature could not be in harmony with the curvature of movement of the mandible, and yet it is self-evident that the relation of occlusal curvature of the lower teeth to that of the upper teeth changes when the mouth opens. Instead of thinking of a long radius on the anterior teeth and a shorter one on the posterior teeth, think of the center of curvature of the lower occlusal surface following the curvature, thereby maintaining equal radii for all teeth in the finished restoration. This fact can be demonstrated and must be respected if one is to establish occlusal form in harmony with mandibular movement.

Muscular forces produce and determine the direction of mandibular movements. As I have stated before, muscles guide the mandible in its movements. Dental literature informs us that cases are on record wherein one or both condyles have been removed without any appreciable change in the mandibular movement. If the glenoid fossae along with the condyles constituted the guiding influences, one would suppose that removal of condyles by surgical interference would cause considerable disturbance. I cannot subscribe to the doctrine that the form of the temporomandibular joint determines the nature of mandibular movement. Facts do not substantiate such a belief.

Physics deals with applied forces and resultant forces without any mention of the source or nature of the applied forces. They may be forces exerted by the wind, a team of horses, an electric motor or any other agency. Muscular forces can haul or lift heavy loads: why cannot muscular forces determine direction of movement of a mandible? If, for instance, a horse is pulling in a northerly direction, while another horse is exerting an equal effort in an easterly direction, we know that the object being moved will move in a northeasterly direction. If, for instance, a force of three units in one direction, and a force of four units at right angles to the first is expended on a movable object, we know that the resultant force is five units, in the direction of the diagonal of a rectangle whose dimensions are 3 by 4. The same applied forces of three and four units, if applied in other than right angle directions, could produce resultants equal to one unit, less than five units or more than five units, to the limit of seven units, when both forces of three and four units are applied in the same direction. Since origins and insertions of muscles do not change, it seems obvious that when one set of muscles opens the mouth, those which produce the lateral or protrusion movements are influenced to the extent of producing a resultant direction of movement in accordance with the diagonal of a parallelogram of forces. Furthermore, even if guide planes of adaptable articulating instruments are set to a certain extreme lateral or protrusion movement, wherein a condyle would already have traversed the entire possible distance over the glenoid fossa, another wax bite of increased vertical dimension, and equal range in the same direction, will impose a still greater angle of declination on the planes of orientation. Surely this cannot be accounted for by citing the form of a glenoid fossa, a form which remains constant.

As many of our bodily movements are compared to movements produced by some classification of the lever, the movements of the mandible may be classed as resultants of applied muscular forces. It seems a more logical, scientific reason. Where force and motion are concerned, we cannot entirely divorce anatomy from mechanics.

While the Monson theory and instrument have been described as "arbitrary," it follows that movements and the resulting positional relations of the teeth are likewise governed by some arbitrary law. Surely, if the Monson articulating instrument can check any bite made by the patient, and the instrument is considered arbitrary, the human action is also arbitrary. The process of checking may even be reversed.

If, for instance, a wax checkbite within the range of mandibular action is made by casts on the Monson instrument, they may be placed in position in the mouth, where it will be found that the natural teeth assume the same relative positions as the casts which produced the wax bite record.

We can reach but one conclusion: If the Monson articulating instrument is arbitrary, mandibular movement is arbitrary in that it is governed by an orderly geometric scheme. It is this scheme of movement which we have been trying these many years to understand, and which is the underlying reason for our endeavor to build occlusal surfaces to spherical forms.

Instead of producing spherical movements in an articulator, we have, in the past, had to be satisfied with action guided by planes of orientation, where condyle points followed secants or tangents. Mandibular movement has subsisted since man's entry into this world, and it has been our task as dentists to provide substitutes for missing natural teeth. In this ever-changing effort in trying to improve these substitutes for the missing teeth, many procedures and technics have been developed. In many instances, when a new procedure is presented, the proponent of that procedure undertakes to promote a new theory of mandibular movement, while proclaiming the spherical theory. I have no quarrel with any man as to what articulating instrument he uses, or whether he uses any articulating instrument. If he can establish a balanced occlusion without the use of an articulating instrument, that is his privilege, but let him be certain that he understands the meaning of the term "balanced occlusion."

Such an achievement should not be an excuse for our failure to further study mandibular movement, trying to place it within the realm of a classified science where it can be described as an orderly, consistent movement. No matter what height of achievement in prosthetic dentistry is attained, mandibular movement subsists as it always has, and probably always will.

The wonder to me is that an ever-increasing number of dentists are being converted to the spherical theory, to the extent that dental laboratories have recognized the demand and are equipped to, at least, attempt such reproductions, and yet there has been little interest in the reason for spherical occlusion.

Dr. Monson's reason for advocating spherical occlusal form was that occlusal form should be in harmony with mandibular movement. Merely building the occlusion to spherical form is not enough. The spherical occlusal form must occupy a specific position with respect to its surroundings, such as the upper teeth and the center of muscular balance, which determines the direction of movements of the mandible. It was in his study of movements of the mandible that his the-

ory of proper occlusal form had its inception. Movements dictated form. Curvature of motion and its center always maintain a constant relation. If occlusal form is to harmonize with curvature of movement, the center of occlusal curvature must be coincident with the center of curvature of movement.

It has been said that three wax bites represent cusp relations in but three specific positions, without presenting any evidence of cusp relations between these three positions. That is true, but a line of movement whether straight or curved is but a succession of points, and there is nothing to prevent anyone from obtaining a succession of intervening points, even if it were necessary to obtain fifty wax checkbites in the same direction of range. Of course, let it be understood that out of that number of checkbites, only those of equal opening component would serve the purpose in establishing the locus of spherical movement. As in industry, when it becomes necessary to know specifically what course is traversed by a moving part, enough successive positions of the part or point are plotted to present some evidence of the form of the line followed. The plotted points are connected by a continuous line, and it then remains to determine by algebraic equations whether the moving part is following a straight line, an arc of a circle, a parabolic curve, a curve of an ellipse or some other curve. The values for every pair of coordinates of plotted points must satisfy the equation, and the locus can contain no other points than those which satisfy the equation.

This takes us into analytic geometry, which at present is impractical for our purpose, since the moving points, the centers of the condyles, lie approximately one half inch beneath the surface of the skin. The point which I am trying to illustrate is that a curve of motion is but a succession of points, and the locus of such plotted points represents the curve of motion. Instead of considering mandibular movement the result of one impelling force, we must consider it, and describe it, as the result of the spherical movement and the opening movement, two influences acting simultaneously. As the ratio of these two movements varies, so will the resultant movement as it appears to us vary. We must segregate these two components of a bite movement when speaking of mandibular movement.

On the other hand, if the direction of movement has been analyzed as suggested, and the curve of mandibular movement has been anticipated, and a vehicle designed and constructed to carry the point to be plotted along a certain predetermined curve, and positional relations point to the correctness of this curve of movement, we may conclude that the point moves along this anticipated curve. Such a situation exists when casts are correctly mounted on a Monson instrument.

The statement that articulators cannot accurately reproduce individual movements of the mandible because the movements are too intricate and variable to permit of accurate mechanical reproduction of them is manifestly a misapprehension. In the first place, the Monson articulating instrument can reproduce any movements made by the mandible, and, in the second place, mandibular movements are not too intricate or variable to permit of mechanical reproduction. Accurate reproduction of mandibular movement is an accomplished fact, statements to the contrary notwithstanding.

When hundreds of cases have already been checked in almost every conceivable range of occlusal relation, it indicates that the principles embodied in the design of the Monson instrument are applicable to mandibular movement; otherwise, bite

relations could not be checked on the instrument. Furthermore, if a dentist accepts the doctrine of spherical occlusal form, he has already subscribed to the Monson theory of mandibular movement.

I have before me a reprint of a paper presented by J. Leon Williams,[2] wherein he champions the spherical theory. On page 2 of that reprint appears a footnote which reads as follows: "I did not know until this work was completed that Dr. George S. Monson had reached conclusions very similar to those presented in this paper with reference to the curves of the sphere being the fundamental ideal curves on which the mandible moves."

I believe that we all consider the late Dr. Williams a sincere student, whose conclusions were the result of persistent effort in seeking the truth.

If the future is to produce more satisfactory prosthetic appliances or restorations, our study of occlusal form must depend on a thorough study of mandibular movement under the classification of descriptive geometry. By that means, we lift the subject of mandibular movement out of the slough of darkness and mystery and place it within the realm of a classified science, where it can be more easily studied. There may be cases which cannot be checked to the spherical theory, but they are the exceptions. I should not dismiss a case as an exception merely on hearsay. My own experience prompts me to make this statement. In the early days of my contact with Dr. Monson's work, a supposedly proficient disciple of Dr. Monson's, sent to our city to direct a class in checking casts, failed to check casts of my teeth in wax checkbites made by me. Later, another facebow transfer made by two of my colleagues who had witnessed the failure produced satisfactory results. Manifestly, if the transfer is in error, failure in checking is inevitable.

2. Williams, J. L.: Study of Temporomandibular Joint with Special Reference to Form and Action of Masticating Surfaces of Teeth, J.A.D.A., 8:274 (April) 1921.

CONCLUSION

I am convinced that mandibular movement, instead of being so intricate and varied that it should be considered a maze of disorderly movements, is in reality a succession or combination of orderly movements.

It is the mission of dentistry, as a learned profession, to concern itself as much with the scientific aspect of mandibular movement as it is to engage in hot pursuit of this or that new procedure for replacement of an entire dentition. If mandibular movement is clearly understood, more successful and lasting procedures for replacement of missing teeth may result.

From this analysis of mandibular movement, we may conclude that spherical occlusal form is a logical requirement.

AN INVESTIGATION INTO THE POSSIBLE RELATIONSHIP OF AMMONIA IN THE SALIVA TO DENTAL CARIES*

By JULIUS WHITE, Ph.D., and RUSSELL W. BUNTING, D.D.Sc., Ann Arbor, Mich.

ONE of the most important phases of the study of dental caries has been the analysis of the saliva in search for some concomitant relationship between the salivary constituents and the activity of this dental disease. Among the chemical constituents studied have been calcium, phosphorus, the chlorides, p_H and carbon dioxide capacity, the enzymes and ammonia.

Very recently, Grove and Grove[1] published a paper in which they claim that the ammonia content of the saliva and the p_H are the controlling factors in dental caries. An article of the same import by the same authors was published in the February issue of THE JOURNAL. They state that salivary ammonia is consistently higher in caries-free than in caries-susceptible individuals. They submit data selected from salivary analyses of 150 cases which they have studied and these data appear to substantiate the hypothesis. The authors state as their opinion that ammonia acts as a solvent for bacterial dental plaques and, by retarding their formation, prevents the characteristic action of caries.

The weight of evidence submitted and the importance of such findings attracted the attention of all students of the subject and have led to inquiry into the question of the relation of salivary ammonia to the activity of dental caries. One such investigation has been made by the Michigan caries research group in an effort to determine whether the findings of Grove and Grove might be verified. The following statement is a detailed report of this investigation, presenting the data obtained in the estimation of salivary ammonia in well-selected cases of caries-susceptible and caries-free persons.

Twenty-five cubic centimeters of activated saliva obtained by paraffin chewing was collected from each subject. Immediately after collection, from 2 to 4 drops of chloroform was added as a preservative. In no case did the time of collection exceed thirty minutes, the average being fifteen minutes. The time that elapsed between the collection of the sample and the start of the analysis was never more than ten minutes. It was found that chloroform[2] checked the further formation of ammonia by bacterial action, so that samples thus preserved could stand several hours before the determination of ammonia was made. In

*Study made as a part of the Dental Caries Research supported by the Rackham Foundation in the School of Dentistry, University of Michigan.

*From the Department of Physiological Chemistry, School of Medicine and the Department of Oral Pathology, School of Dentistry, University of Michigan.

1. Grove, C. T., and Grove, C. J.: D. Cosmos, 76:1029 (Oct.) 1934.

2. Updegraff, H., and Lewis, H. B.: J. Biol. Chem., 61:633 (Oct.) 1924.

TABLE 1.—DATA FROM CARIES-FREE SUBJECTS

Subject	Age Yr.	Time of Collection	p_H	Ammonia N per 100 C.c. Saliva Mg.
F.B.	14	4:00 p. m.		11.32
				7.35
		4:00 p. m.	7.4	7.63
		4:00 p. m.	7.4	7.35
D.J.*	12½	6:00 a. m.		8.68
		6:00 a. m.	7.1	7.49
		3:30 p. m.	7.5	8.89
		3:30 p. m.	7.4	8.12
R.Sn.*	11¾	6:00 a. m.		6.37
		6:00 a. m.		7.21
		3:30 p. m.	7.3	5.39
		3:30 p. m.	7.1	5.88
		3:30 p. m.	6.8	5.46
G.I.*	11¼	6:00 a. m.		9.45
		6:00 a. m.		8.68
		3:30 p. m.	7.2	10.36
		3:30 p. m.	7.1	9.59
		3:30 p. m.	7.2	9.73
H.L.V.*	12	6:00 a. m.	7.3	5.39
		6:00 a. m.	7.3	4.69
		6:00 a. m.	7.2	8.19
		6:00 a. m.	7.3	5.60
Ro.N.*	12¾	6:00 a. m.	7.2	9.24
		6:00 a. m.	7.3	5.60
		6:00 a. m.	7.2	8.40
		6:00 a. m.	7.6	8.26
O.R.*	15¾	6:00 a. m.	6.9	8.40
		6:00 a. m.	7.0	7.07
		6:00 a. m.	7.0	7.63
A.P.*	17	6:00 a. m.	6.9	15.12
		6:00 a. m.	6.9	16.87
		6:00 a. m.	6.9	9.94
E.G.*	14¾	6:00 a. m.	7.2	10.22
		6:00 a. m.	7.1	10.01
		6:00 a. m.	7.0	5.39
		6:00 a. m.	7.1	5.88
R.B.*	13½	6:00 a. m.		6.50
		6:00 a. m.		7.77
		6:00 a. m.	7.1	8.12
		6:00 a. m.	7.1	8.40
		6:00 a. m.	7.1	9.94
M.A.*	13	6:00 a. m.	7.1	8.26
		6:00 a. m.	7.2	8.33
		6:00 a. m.	6.9	9.03
V.M.*	11	6:00 a. m.		10.57
		6:00 a. m.		13.23
		11:00 a. m.	7.2	20.09
		11:00 a. m.	6.8	20.37
		11:00 a. m.	7.1	20.44
I.C.*	9¼	6:00 a. m.		11.13
		6:00 a. m.		10.64
		11:00 a. m.	7.5	10.01
		11:00 a. m.	7.1	6.72
		11:00 a. m.	7.0	9.24
D.T.*	10½	11:00 a. m.	7.2	10.85
		11:00 a. m.	6.8	10.50
		11:00 a. m.	7.1	11.83
P.S.*	10¼	11:00 a. m.	7.4	8.19
		11:00 a. m.	7.0	10.85
		11:00 a. m.	7.2	7.49
R.D.*	9¾	6:00 a. m.		6.09
		6:00 a. m.		6.72
		11:00 a. m.	7.4	11.55
		11:00 a. m.	7.0	8.26
		11:00 a. m.	7.0	7.00
M.B.*	13¾	11:00 a. m.	7.0	8.96
		11:00 a. m.	7.0	7.42
		11:00 a. m.	6.8	8.05
S.C.	25	1:00 p. m.		10.50
		1:00 p. m.	7.4	8.42
		1:00 p. m.	7.1	9.70
C.O.H.	36	11:30 a. m.	7.5	13.30
		11:30 a. m.	7.3	11.05
		3:00 p. m.	7.3	11.70
R.P.	13	4:00 p. m.		4.06
		4:00 p. m.		5.81
		11:00 a. m.		4.13
		4:00 p. m.	7.2	5.74
B.G.	13	4:00 p. m.		3.64
		4:00 p. m.	7.2	4.48
		4:00 p. m.	7.2	4.48

*Orphanage children.

TABLE 2.—DATA FROM CARIES-SUSCEPTIBLE SUBJECTS

Subject	Age Yr.	Time of Collection	p_H	Ammonia N per 100 C.c. Saliva Mg.
Ri.B.*	14	4:00 p. m.	7.3	9.87
		4:00 p. m.	7.2	10.64
		4:00 p. m.	7.1	10.22
Ro.B.*	11¾	4:00 p. m.	7.3	12.60
		4:00 p. m.	7.0	11.27
		6:00 a. m.	7.1	11.76
		6:00 a. m.	7.2	9.10
G.S.*	15	6:00 a. m.		8.47
		6:00 a. m.		9.72
		4:00 p. m.	7.2	10.71
		4:00 p. m.	7.0	10.99
		4:00 p. m.	6.9	10.78
K.M.*	13	6:00 a. m.		10.08
		6:00 a. m.		9.72
		4:00 p. m.	7.4	11.69
		4:00 p. m.	7.1	10.78
		4:00 p. m.	7.1	11.34
B.D.*	11¾	6:00 a. m.		4.34
		6:00 a. m.		5.04
		4:00 p. m.	7.4	5.88
		4:00 p. m.	7.1	5.60
		4:00 p. m.	7.2	5.67
W.M.	35	11:00 a. m.		4.34
		11:00 a. m.		6.16
		11:00 a. m.	7.6	7.07
		11:00 a. m.	7.4	6.43
J.B.	14	11:00 a. m.		5.67
		11:00 a. m.		4.48
		4:00 p. m.	7.3	5.46
		4:00 p. m.	7.3	6.98
J.R.	20	4:00 p. m.		4.06
		4:00 p. m.		7.07
		11:00 a. m.		6.93
		11:00 a. m.	7.3	5.36
		4:00 p. m.	7.1	7.63
R.N.*	17	6:00 a. m.	7.0	6.51
		6:00 a. m.	7.4	4.76
		6:00 a. m.	7.3	2.73
		6:00 a. m.	7.1	5.60
J.D.F.	17	4:00 p. m.		18.06
		4:00 p. m.		26.32
		4:00 p. m.	6.9	14.77
		4:00 p. m.	7.1	18.12
F.B.	17	4:00 p. m.		10.92
		4:00 p. m.		12.88
		4:00 p. m.	6.9	10.92
		4:00 p. m.	6.8	9.03
C.A.C.	37	11:00 a. m.		10.50
		1:00 p. m.	7.4	8.30
		1:00 p. m.	7.4	8.80
M.F.	23	11:00 a. m.	7.1	10.50
		11:00 a. m.	7.0	10.20
		11:00 a. m.	6.8	10.36
Ross	21	11:00 a. m.	6.8	7.98
		11:00 a. m.	6.8	10.79
		11:00 a. m.	6.7	12.95
P.W.	16	11:00 a. m.	7.3	6.86
		11:00 a. m.	7.4	9.10
		11:00 a. m.	7.2	8.26
W.R.C.	20	11:00 a. m.	6.8	7.98
		11:00 a. m.	6.8	8.33
		11:00 a. m.	6.9	8.47

*Orphanage children.

every case, the p_H was determined immediately after the samples were collected.

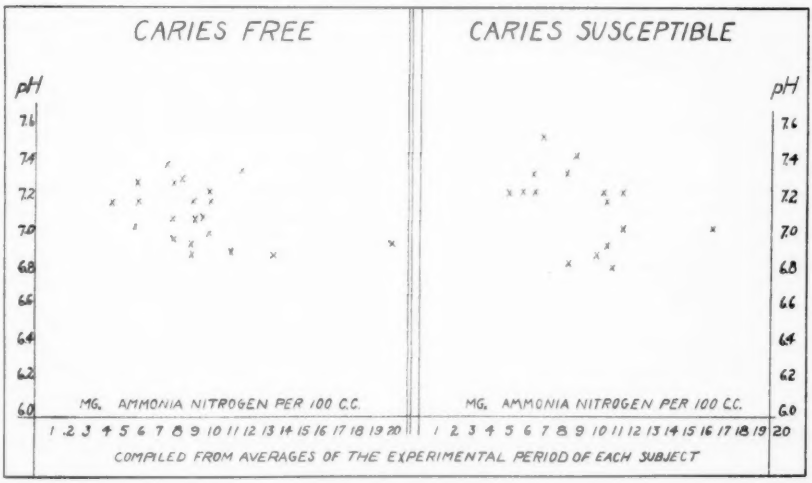
The subjects used ranged in age from 9 to 40 years. One group consisted of twenty-two children living under uniform conditions in an orphanage. The remaining fifteen were public school children, university students and faculty members. The dental history of each subject was well known. Many of them had been under observation for four years. The specimens of saliva were col-

lected at several different times of the day. In no case was any specimen taken earlier than three hours after a meal.

The ammonia content was determined by a modification of the aeration method of Folin.[3] The modified method consisted of treating 2 c.c. of saliva with 5 c.c. of a standard solution of sodium carbonate, passing air through the solution for two hours and absorbing the liberated ammonia in a standard acid solution. The amount of acid not neutralized was determined by titration with a standard alkali. The total amount of ammonia present in the saliva could then be computed. Duplicate determinations were carried out in every case. The p_H was determined colorimetrically by the use of phenol red as an indicator.

In order to be certain that the method of aeration was applicable to saliva, several preliminary experiments were carried out. Known solutions of varying amounts of ammonium sulphate were aerated. The ammonia of specimens containing as little as 1.065 mg. of nitrogen was quantitatively recovered. Likewise, preliminary experiments were conducted to determine whether ammonia added in known quantities to saliva could be recovered. Repeatedly, samples of saliva were aerated with and without added amounts of ammonia. The recovery of ammonia in no case was less than 99 per cent. Since the samples were aerated for two hours, it seemed possible that the sodium carbonate added to liberate the ammonia might cause the liberation of the ammonia of the protein of the saliva by hydrolytic action and thus give abnormally high values. Six representative specimens of saliva were each aerated for two, four, six, and eight hours, respectively. The amount of ammonia recovered was the same regardless of the duration of aeration, which indicated that the sodium carbonate was not liberating the ammonia by decomposition of the protein of the saliva to give higher results.

From the data presented, no conclu-



3. Folin, O.: Z. Physiol. Chem., 37:161, 1902-1903.

sions can be drawn as to the relationship between the ammonia and the *pH* of the saliva and the activity of dental caries. The variations in the *pH* and ammonia of the saliva of the caries-susceptible persons were about the same as those of the caries-free group.

Since the ammonia determinations of Grove and Grove[1] were not carried out by this method, we attempted simultaneous determinations by means of their method. (More detailed directions were obtained from Grove and Grove in a private communication.) This involved the treatment of 2 c.c. of saliva with permutit, the liberation of the ammonia with alkali, nesslerization and final dilution to 200 c.c. The resultant color was compared in a colorimeter with that of a standard ammonium sulphate solution similarly treated. They have reported a maximum of 10 mg. of ammonia nitrogen per hundred cubic centimeters of saliva. This means that, in 2 c.c. samples of saliva, the maximum ammonia determined was 0.2 mg. of ammonia nitrogen. One cubic centimeter of solutions of ammonia containing 0.2, 0.3, and 0.4 mg. of ammonia per cubic centimeter were treated as above and diluted to 200 c.c. The colors developed in each case were so weak that it was impossible to read them in the colorimeter with any degree of accuracy. Even when the final dilution after nesslerization was 100 c.c., it was not possible to obtain satisfactory readings.

We used pure ammonia solutions in amounts up to 0.426 mg. of ammonia nitrogen, an amount twice as large as the highest reported by Grove and Grove, but failed to obtain solutions which were readable without doubt as to the accuracy. Samples of saliva were treated according to their method with and without added amounts of ammonia. In no case was the added amount of ammonia recovered quantitatively, even though this experiment was repeated at least twenty times.

The results obtained by the Grove and Grove procedure very rarely checked with those obtained by the method of aeration. When the ammonia content was greater than 10 mg. per hundred cubic centimeters of saliva, fairly comparable results could be obtained. With smaller amounts, the readings were difficult, so that when this method checked with the aeration method, which was not often, it was probably a coincidence rather than an actual check.

Schmitz,[4] Hench and Aldrich,[5] Morris and Way[6] and Updegraff and Lewis[2] have reported that the sum of the urea and ammonia nitrogen of the saliva is roughly parallel to the urea nitrogen of the blood, but that it is somewhat less. They believe that the ammonia originates from decomposition in the mouth of the urea normally present in saliva. Morris and Jersey[7] have reported that resting saliva contained from 6.8 to 12.3 mg. of ammonia nitrogen per hundred cubic centimeters. They believe that the variability of salivary ammonia is due to the hydrolysis of the urea normally present in the saliva. No study was made concerning any possible relationship between the ammonia content of the saliva and dental caries. Hench and Aldrich believe that the ammonia arises from the hydrolysis of the urea to form ammonium carbonate. These facts would seem to indicate that ammonium salts are not necessarily an indication of a "metabolic

4. Schmitz, H. W.: J. Lab. & Clin. Med., 8:78 (Nov.) 1922.

5. Hench, P. S., and Aldrich, M.: J.A.M.A., 64:1409 (Oct. 21) 1922.

6. Morris, J. L., and Way, C. T.: J. Biol. Chem., 59:xxvi, 1924.

7. Morris, J. L., and Jersey, V.: J. Biol. Chem., 56:31 (May) 1923.

process," but are evidence of a secondary change.

Grove and Grove recommend an alkaline diet to increase the amount of ammonium salts in the saliva. No data are available on the change in the ammonia concentration of the saliva after the ingestion of alkaline foods. We cannot see how this change in diet could increase the ammonia of the saliva if the ammonia arises in the mouth from decomposition of urea.

We are cognizant of the fact, as were Grove and Grove, that the p_H as determined was not the true p_H of the saliva, since the carbon dioxide was being evolved continuously. We carried out our experiments as outlined, since it was desirable to have our conditions as nearly similar to theirs as possible.

This work, as well as that of Grove and Grove, deals with the ammonia from activated saliva. Further work is necessary to determine whether there is any difference between the ammonia content of resting and that of activated saliva.

CONCLUSIONS

The reaction (p_H) and the ammonia content of activated saliva (paraffin) showed marked variations.

No significant differences between the amounts of salivary ammonia in caries-free and caries-susceptible individuals were observed.

It has not been possible to correlate the ammonia content and the p_H of activated saliva with the occurrence of caries as suggested by Grove and Grove.

Treatment of Hemophilia

Summary: 1. In view of the prominence of the hereditary character of hemophilia, an effort should be made by eugenic methods to control its spread. However, in certain cases, the occurrence of hemophilia is familial. 2. The number of children in a hemophilic family is considerably greater than that of the average American family. 3. Prophylaxis of attacks of bleeding is attained by the avoidance of trauma and by proper preparation before the undertaking of any operative procedure. 4. Skin bleeding time may be lengthened during the acute bleeding phase. 5. The intravenous transfusion of unmodified blood constitutes the best method for the prevention and treatment of acute attacks of bleeding. Citrated blood produces similar results, but in our hands reactions are experienced more frequently. 6. Intramuscular injection of whole blood (20 c.c.) has seemed to benefit some patients. 7. Fresh serum is a satisfactory local hemostatic agent. 8. The trial of defibrinated blood injected intravenously is indicated. 9. Endocrinotherapy, according to our criteria, has been of no value. 10. Any therapeutic measure that diminishes venous clotting time and does not lessen the bleeding phenomena, or even increases them, should be avoided. 11. The use of special diets has proved disappointing. 12. Intradermal injections of antihuman platelet serum was followed sometimes by a marked decrease of the venous clotting time in three hemophilic patients, two of whom were going through an acute phase of bleeding; no prompt and permanent cessation of the bleeding followed the injections. 13. In an acute emergency due to hemorrhage, intraperitoneal transfusion is not indicated. Blood must be injected into a vein.—Harold W. Jones and Leandro M. Tocantins, in *J.A.M.A.*, Dec. 1, 1934.

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Editorials

WATCH CONGRESS

It may seem a foolish and futile bit of advice to suggest that professional men and women concern themselves with the legislative affairs of the nation, but when we consider the astounding obsessions of certain of our present day legislators, it behooves every intelligent citizen to keep his ear to the ground and study with some concern the various tendencies of the hour, to the end that he may have an intelligent reaction to the current issues of the day.

Presumably, the intellectual level of the professional man is at least on a par with that of the average citizen, and it must be remembered that this same Mr. Average Citizen is the one who in the aggregate controls the destinies of the nation. If we sit supinely back and permit every innovation to go by default without an analysis of its inherent defects or its problematic virtues, we may be contributing to a possible miscarriage of justice in as certain a degree as if we openly advocated a false measure.

No one man seems to count for much in any political issue, particularly a professional man, but the cultivation of a sentiment among an appreciable number of the profession often tells a different story. In the state legislatures in particular, a united effort on the part of some of the dental societies has turned the tide and defeated what would otherwise have been some vicious legislation. In politics, numbers count, and often the most effective argument is a vote.

As just intimated, the intellectual caliber of the ordinary professional man should at least measure up to that of our citizens in general, and it is therefore incumbent on the profession to exercise the prerogative that nature and education have bestowed on them and utilize the judgment that is inherently theirs.

Thus, a careful study should be made of the current issues of the day by every professional man and woman, and that means by every dentist whether in organized dentistry or out of it. We know of course that organization has meant the salvation of the dental profession, and the only thing that will keep us saved is to maintain a strong organization. But even organization itself cannot function to its fullest efficiency without the stimulating influence of new ideas, and without the reaffirmation of those principles that have unerringly proved the safeguard of our political faith.

What concerns us most at this time is the pronounced tendency on the part of some of the profession to be stampeded out of sanity and common sense by the present emergencies. There is no questioning the fact that conditions have been difficult, and that men and women have suffered, but unless this nation has gone soft completely, there is sufficient mental and physical stamina in our people to pull themselves together, garner the loose ends of the economic fabric and proceed along the line of those policies that have built the nation and the profession in the first instance.

The constant cry of "wolf, wolf" will not get us anywhere, and this is the most vociferous cry that has assailed our ears in recent times. This cry has gone out from the highways and byways of this land of ours till it threatens to be the shibboleth of the hour. Capital has been made of a calamity called a depression, and an emergency has been seized to fasten on us certain pernicious and detrimental

policies that the revolutionists are seeking to make permanent. Propaganda has been used incessantly in season and out of season, and now the campaign is to be carried to congress and the state legislatures.

Well, let it come. If the citizenry of this country have completely lost their mental balance, the sooner we know it the better. But we have sufficient faith in the essential integrity and good sense of the American people, and by the same token we have sufficient confidence in the ultimate intelligence of our own profession, to be confident that when the crucial test comes, it will find us on the side of sanity and fair repute.

Questionnaires may come and go, and conjectures may be advanced therefrom, but questionnaires never settled an issue of this sort yet, and they will not settle it now. Even if through the machinations of an aggressive group, a certain element of the profession becomes stampeded into the promotion or advocacy of unsound policies, there is no indication that when the deliberate and sober sense of the American people and the dental profession has said its final word, the verdict will leave us in the bog and mire of uncertainty and insecurity.

But we must do something more than merely protest: we must be prepared by calm deliberation and by constructive reasoning to head off, through argument and conviction, extreme measures dangerous to the welfare of society. We should conscientiously make ourselves familiar with every new measure introduced in our legislative halls, and analyze it calmly and logically in relation to its ultimate effect on the social fabric. New legislation will be proposed without question in various states, even where there is no apparent call for it, and it is our duty to watch carefully for pernicious provisions, and be prepared to submit substitutions of a more logical and constructive character to checkmate any dangerous enactments. We must never sleep till this fever of legislative unrest subsides, and we are able to proceed securely and serenely in waters that are calmer and less prone to agitation. We must be ready with constructive suggestions at the same moment that we are forced to defend ourselves against destructive influences.

Legislatures may vote—if it comes to that—to fasten on us the

incubus of state control of our professional policies, but the time will never come when the thinking men of the profession will submit to dictation by state officials as to how they shall practice their profession. The present regulations and safeguards for the protection of the public by state laws as to professional qualification for entrance to the profession are perfectly proper and are necessary, but this is an entirely different matter from the idea of forcing on the profession, after the professional qualification has once been established, a system of practice that is inimical to the best interests alike of the profession and the people.

The whole category of state health insurance, state dentistry, panel dentistry, social dentistry or any other socialized movement that threatens to take away from the profession the prerogative of directing its own destinies along the lines of the well-known principles that have given us and the public the greatest security and the most certain progress in the past cannot be held out as a bait to trap the unwary. We know what we are able to do for the public weal by following the well-established ideals of dentistry as laid down by the founders and builders of the profession, but we do not know what can be done or what will be done if legislators try to force by enactment a system of dental practice that is inimical to the best interests of all concerned.

Mayhap, therefore, the idea contained in the admonition to "watch congress" is not so far fetched or impractical is it might seem.

ARRANGEMENT OF LIGHT IN THE OPERATING ROOM

The short dark days of the winter months bring home to the operator the necessity of conserving in every way at his command the precious boon of light. Many operators fail to get the most out of the light that nature provides for them. Through faulty arrangement of the light in the operating room, they minimize the benefit that might come to them, and, in many instances, they do themselves actual injury by causing an eye strain, which is wholly unnecessary.

The generally accepted idea seems to be the more light in the

operating room the better, but this is a fallacy. What is needed is not a great flood of light all over the room, but a good quality of light, directed if possible from the sky to the vicinity of the patient. Large windows are unnecessary. A relatively small window so placed that the light is concentrated on the patient's face and mouth will serve a better purpose than if the whole side of the room were glass. Any unnecessary or divergent rays coming into the room are a detriment. Cross rays from a window other than the one in front of the operating chair do more harm than good. In particular, cross rays directed toward the operator's face detract from the effectiveness of the work and at once cause an eye strain that is liable to ruin the operator's eyes.

The walls in the operating room should be of neutral or subdued tint. Bright walls inevitably reflect the light and cause undue eye strain. Above all things, the operator should not face a bright wall, as this will detract from facility in looking in the mouth and will cause constant strain. If the operating chair is unavoidably placed near the wall at the left of the chair, the color of the wall should be toned down so that the light is absorbed rather than reflected.

A soft chocolate shade is admirable for an operating room. Probably fully as effective is a green. A white wall is fatal to the comfort and efficiency of an operating room. Too much white in the equipment is harmful, and the white enamel scheme has been greatly overdone, to the operator's detriment. All frills and furbelows, if frills and furbelows must be had, should be reserved for the reception room, but the operating room, where most of the practitioner's time is spent, should be consecrated to utility, safety and comfort

An operating chair facing a bay window is bad unless that part of the bay that faces the operator is shaded, and, above all things, a window in the wall in front of the operator as he stands at the chair is ruinous to his eyes. Many an operator has unconsciously subjected himself to discomfort by failure to recognize the essentials in light arrangement for his operating room, and doubtless numberless instances have occurred wherein a permanent injury has resulted to the operator's eyes through ignorance, or through lack of attention to the necessary precautions. Eye strain is sometimes insidious, and the operator should be constantly on the alert to guard against it.

Much can be done by an intelligent study of the conditions present in each operating room, and this study is well repaid by a better protection to the operator's eyes.

A great deal has been written about the best kind of a natural light for a dental operating room, whether a north, south, east or west light, but this is a subject that is not so easily disposed of. The operator has not always a choice in the matter, and if the truth be told, there are advantages and disadvantages to be considered in each instance. The time of the year and the consequent location of the sun is a circumstance to be thought of in this connection, and altogether there are so many pros and cons that little definite advice can be ventured.

But the arrangement of light in the operating room itself is something for the individual practitioner to study with profit when once his room is located, and it is a matter concerning which too much consideration cannot be given. It may mean the difference between a safe and comfortable performance of the daily task, and a hazardous and damaging eye strain that may injure the operator's vision and mar his professional life.

THE JOURNAL OF THE CANADIAN DENTAL ASSOCIATION

For some time, there has seemed a need of an official organ for the Canadian Dental Association, and at the beginning of the year the consummation came and a new journal was launched. We have gone over the first number with some care, and we congratulate all those who have in any way been instrumental in producing it. This issue consists of fifty-two pages of interesting reading matter, made up naturally mostly of a pronouncement of policies and the outlining of plans for an organ of this character. A French section is provided to care for the needs of the profession in the Province of Quebec.

The editor-in-chief of the new publication is M. H. Garvin, of Winnipeg, Manitoba. The editor of the French section is Philippe Hamel, of Quebec. Both men are well qualified to fill the places

allotted to them. Dr. Garvin's "Salutation" is a strong and comprehensive statement of the editorial aims and ambitions of the coming journal, and if the fulfilment measures up to the promise, as doubtless it will, Canada will have a national dental representative of which it may well be proud.

The associate editors are selected, one from each province, and will form a strong contributing group to support the major policies of the organization. The business manager is Stephen A. Moore of London, Ontario, and the publication office is in Toronto.

It is needless to say that we extend our most fraternal greetings and cordial good wishes to the officers and the editorial staff of the Canadian Dental Association. The objects and aims of our two national bodies are so similar, and there have always existed such reciprocal relationships between the members of the two associations that a happy consummation is seen in the advance step just made by our sister organization in the launching of their official organ.

The oft-repeated sentiment of "hands across the sea" is in this instance emphasized and, if possible, brought even closer home by the implied sentiment emanating, we are sure, from the membership of both Associations of "arms linked across the lines."

JUNIOR MEMBERSHIP IN THE AMERICAN DENTAL ASSOCIATION

Jan. 31, 1935, the following twenty-two dental schools with their accompanying respective junior memberships in the American Dental Association were recorded:

Atlanta Southern Dental College	2
Chicago College of Dental Surgery	2
College of Physicians and Surgeons	73
Columbia University	24
Creighton University	1
Indiana University School of Dentistry	48
Loyola University	22
Marquette University	79
Medical College of Virginia	24
New York University	1

North Pacific College of Oregon	10
Northwestern University Dental School	42
State University of Iowa	60
Temple University Dental School	44
Texas Dental College	17
University of Illinois	5
University of Louisville	38
University of Maryland	74
University of Michigan	12
University of Nebraska	1
University of Pennsylvania	3
Western Reserve University Dental School	10
Total	592

This is really a most commendable showing on the part of the student body, and the result will mean a large influx of new members of the most desirable type. If a student in college manifests sufficient interest to apply for membership in the American Dental Association, it is proof positive of a tendency that, if carried on through student days, will ultimately launch him on a most promising professional career. The vital need is everywhere apparent of cultivating organization sentiment, and this is particularly true of students in college.

Our congratulations go out to all of those who have in any way contributed to this praiseworthy movement, and we heartily bid welcome to every one of the nearly 600 students who have made their first move toward dental society affiliation.

ANIMAL EXPERIMENTATION

Antivivisection is again bellicose, garrulous, and, as always, illogical and uninformed. As always, too, it is appealing primarily in behalf of the family dog, drawing heavily on the affection of children and not omitting senior sentimentality. To say that converts to antivivisection propaganda are being made in large numbers has point to it, because those converts are voters, and legislators listen to ballots. The impetuosity of the attack being made in different localities leads many to believe that the issue threatens to grow to national proportions.

Obviously, denial of animal experimentation to experimental medicine would be disastrous. No medical or dental thinker needs explanation or argument, but the wielder of votes probably does. Those who have a favorite dane, setter or scottie are asked to see their own pet as the experimental animal quivering in fear, fighting knife points and scissors, bloody and frothy, straining against death. So such owners see the laboratory through outraged affections as a place of helpless suffering and horror, the workers as exultant torturers, sadists, brutes. One wonders why the frog, mouse, rat and rabbit are slighted. All have been pets anon and their necessary deaths have extracted childish tears. Such creatures too have aided in the struggle against disease and should share honors with "man's best friend," but they haven't the lacrimal drawing power. With the dog placed so nearly on a level with man as the antivivisectionist would have him, one wonders what the emotions of the dog-lover must be who, because of the 14-year-old infirmities of his pet, must have him chloroformed or shot to give him a death preferable to a natural one. Or is he in reality ridding himself of the bother of caring for his "pal" in his last illnesses. Surely, if the dog ranks so close to human worth, his old age deserves that much devotion. If the first be true, does the black guilt of murder haunt him the rest of his life? By easy analogy, it should.

Killing is an age old necessity, for much less worthy reasons than to save mankind from disease. Animals have indulged in it with instinctive ferocity, dogs included. Death was the only reward of combat. Our ancestors killed for their safety; we kill for ornamentation. Food and fun has been justification of the hunt and kill. "Rise, kill and eat" is an injunction that came out of the clouds. Eat to live; kill to eat; kill to live. Disease means suffering, incapacity and death. Is it wrong to kill to live in this instance? All experimental animals are not killed by any means, but if they were, doesn't justification still remain if they die that men may live?

Recently, a valuable kennel suffered from disease. Veterinarians were baffled. Experimentation was undertaken. Dogs were used. The kennel was saved—by the death of dogs, dogs were saved from death. What a puzzle for the antivivisectionist! We increase the puzzlement by placing beside the suffering foxhound an equally

sick and suffering child. Now what? If the suffering child were his own and his own dog were really required, would the anti-animal experimentation defender object?

Antivivisectionists, as they are pleased to call themselves, play fast and loose with words and facts. The very name they choose has a loose connotation. If the term "cutting while alive" abets their propaganda, they refuse to elucidate or modify it. When the word vivisection is applied as in their propaganda, the extraction of a tooth or the removal of an appendix becomes vivisection. Also the "your dog and mine" of their preachments is not true, but rather animals that have been gathered from the streets into pounds and are doomed to death by asphyxiation or other methods, dogs that scavenge, roam the streets and threaten children and adults, dogs that do not deserve sainthood and for which death on the streets is by violence. In the laboratory, these animals perform a service in their death, if they die, and, whenever or however treated, are handled with exacting care. On that care depends the answer to the operator's quest. He cares for his animal as he cares for the problem he would solve. Once there was vivisection to be sure. Amputations were done that were actually "cutting while alive," and what is more, with the animal awake. But there were no anesthetics. No sane person who has visited a reputable physiologist at work would raise the charge of cruelty. And no sane person would make the charge without visiting one to learn the truth. Again, logic jumps a cog when men of character and humane purpose are accused of wanton brutality or indifference to the suffering of any creature. And, finally, the opponent of animal experimentation must aver his choice between the sacrifice of animals or the sacrifice of persons. "The more I know of men, the better I think of dogs" may apply to certain men and to certain dogs, but not to the human race.

Dr. A. C. Ivy recently listed some of the triumphs of medicine and surgery acquired by experimentation on dogs:

> It should be remembered that most all we know about blood pressure, the lungs, liver, stomach, intestines, gall bladder, pancreas, parathyroids and adrenals, and much that we know about the heart, kidneys, spinal cord, brain, and metabolism, have come from experiments on the dog. The discovery of insulin, which will prolong the lives of more than one million people living in the United States today, was made possible almost entirely by experiments on the dog. The discovery of the liver

treatment for pernicious anaemia, formerly an insidiously fatal disease, came from experiments on dogs. The discovery of cortin, which prolongs the lives of patients with Addison's disease, and of parathormone, which saves the lives of patients with parathyroid tetany, both came from experiments on the dog. Many delicate surgical operations, such as the suture of blood vessels, operations on the heart, brain, lungs, and intestines were first tried on dogs. Also, many methods for the diagnosis of disease of the stomach, liver, gall badder, etc., were developed by experiments on the dog.

Eliminate that list and medicine and surgery drops back a hundred years, physicians are as helpless as midwives, hospitals are transformed into morgues and undertakers become capitalists.

The reasons for using the dog in preference to other creatures are obvious enough. They eat about the same food as man and have the same surroundings. The size of the dog makes operations possible that could not be performed on smaller beasts. The structure and function of most of the organs are identical with those of man and react in much the same way to drugs. If they are not used for this purpose, they meet assured death in the pound. Used for experimental purposes, they contribute to man's war against disease. Also, they give to men who would be surgeons practice for the skill they must have to meet the emergencies of the sudden attacks and accidents of human life. Civilization would not lend its worst criminals for the venture, for it still holds its enemies to be human, and the people of no group would barter their own flesh and blood for another group.

Antivivisection, meaning anti-animal experimentation, means antimedicine, antisurgery, antiserum, antivaccine, antihealth service, antihumanity. And that outruns real vivisection in its cruelty. This propaganda the antivivisectionist has rechristened "humane education," an education in misuse of terms, a misstatement of facts, an education of implications and inferences. The adjective is torn from its rootage in the behalf of beasts, and humanity, from which it is derived, is left inhumanly to its diseases.

T.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Torch—A used anesthetic cartridge tube, on heating, can be pulled to a point making a torch that can be used wherever a needle point flame is indicated.—*L. E. Kurth, Chicago.*

Effective Vibrator—By squaring the wooden core of an old brush wheel, an effective vibrator can be made when used on a dental lathe for running up models, etc.—*L. E. Kurth, Chicago.*

Cleaning Crowns and Bridges—To remove excess tripoli and gold rouge from crowns and bridges after polishing, the appliance should be boiled in a solution of water and a washing powder.—*L. E. Kurth, Chicago.*

Good Occlusion and Malocclusion—Good occlusion tends to maintain itself. Malocclusion tends to grow progressively worse through the forces of malfunction operating in the wrong direction or degree. The balance of forces is upset.—*Frank A. Delabarre, Boston, Mass.*

Use of a Disclosing Agent—In most all cases, before starting to clean the teeth, I paint all of them with a disclosing dye, preferably a 2 or 5 per cent solution of mercurochrome. This seems to aid in the cleaning of the surfaces and is a distinct help in keeping tab on the areas that have been gone over.—*Ryland O. Sadler, Baltimore, Md.*

Indications for Gold Foil—If gold foil is as good as the elaborate claims made for it and we are negligent in using it, we are remiss in our obligation to our patients. Failure to tell patients is the sin of omission. Placing other fillings where gold foil belongs is the sin of commission. When the right material is chosen for the proper place, the patient is satisfied and the dentist is gratified.—*H. E. Williams, Red Bank, N. J.*

Rewards—If a reward is due one who adheres tenaciously to the gold foil standard, then it is manifestly fair that he should reap as he has sown. One who sows the doctrine of gold foil is entitled to reap gold dentures. It is much less difficult to induce a patient to accept a gold denture, where other members of the family have had gold foil fillings, carrying the educational assurance of permanency.—*H. E. Williams, Red Bank, N. J.*

Mouth Mirrors—Several mouth mirrors should be kept in use so that an unblemished mirror will be available for reflections. It is much less likely to mislead the operator in what he is trying to see. In using stones in the mouth, the partially scarred mirror is admissible. A reasonably large handle is preferable, as it does not cut so readily into the corners of the mouth as does a smaller one.—*Ryland O. Sadler, Baltimore, Md.*

Speed vs. Hurrying—There is a great difference between speed and hurrying. Speed represents smoothness and efficiency—hurrying means lack of preparation, confusion. A 2:30 pacer makes more fuss than a 2:05 trotter. Hurrying saps more energy than does speed. The state law does not permit your chair assistant to make fillings. The laws of efficiency and common sense do not justify the dentist in doing a single thing which his assistant can do as well or better. This represents a time saving of 20 per cent to the dentist and contributes to his speed without hurrying.—*H. E. Williams, Red Bank, N. J.*

Neatness in Handling Gold Foil—Neatness, thoroughness, painstaking and precision are indispensable attributes to success in dentistry. They must not lead us astray, tempting us to expend too much time in accomplishing a result. Decide when a gold foil filling is complete and leave it alone. Don't go back to it. Go on to the next job because when anything is done it is finished. To spend ten minutes today finishing and polishing something the effect of which will be lost tomorrow is so much squandered effort. Put the time on the fundamentals which make for satisfaction and permanency.—*H. E. Williams, Red Bank, N. J.*

Time Element—The greatest drawback in gold foil procedure is the computation of the time element in hours rather than minutes. Anything figured on the hour basis seems more laborious. The word "hour" itself is suggestive of weariness. Every phase must be considered easy. In olden times, this was termed the "mental factor." Nowadays it is called "psychology." Lower bicuspid occlusal cavities are almost perfectly suited to the physical characteristics of gold foil. These cavities are too far anterior for amalgam, too small for the inlay, while the synthetic group falls far short in crushing resistance.—*H. E. Williams, Red Bank, N. J.*

Eccentricity vs. Enthusiasm—The genuine enthusiasm characteristic of foil advocates is often associated with eccentricity. They have even been called "gold foil cranks," and "narrow minded extremists." Gold foil is an average material. It is a sensible substance. It is intermediate. It fits nicely in between amalgam and the inlay, in both an economic and a practical sense. It is the keystone of the arch, the missing link in the chain, the lost chord in the anthem. It completes the repertoire. Gold foil men have more to offer. They are general practitioners. The dentist who omits gold foil entirely from his program is then in reality the extremist, because he selects only the extreme ends of his list of available materials, leaving out the core entirely—gold foil.—*H. E. Williams, Red Bank, N. J.*

COUNCIL ON DENTAL THERAPEUTICS

Since the recent appearance of reports on agranulocytosis, the Council has received inquiries on the relationship of the disease to the ingestion of amidopyrine and other drugs. Believing that a review of the reports would be of wide interest, the Council requested Paul J. Hanzlik, vice chairman of the Council, who had been collecting information on the relationship of the drugs and the disease, to prepare a report for the Council. The Council adopted the report and authorized its publication in its series of reports on pharmacology and therapeutics.

SAMUEL M. GORDON, *Secretary*.

AGRANULOCYTOSIS: A CRITICAL REVIEW OF CAUSES AND TREATMENT, HISTORICAL AND GENERAL*

By PAUL J. HANZLIK, M.D., San Francisco, Calif.

Agranulocytosis, hypogranulocytosis, agranulocytic anemia, agranulocytic angina, granulocytopenia, primary granulocytopenia, neutropenia, malignant neutropenia, agranulocytic leukopenia, pernicious leukopenia and complete granulopenia are synonyms for the same condition. The term "agranulocytosis" is about as convenient as any, is extensively used and will serve the purposes of this discussion.

Agranulocytosis is a syndrome of systemic symptoms, blood changes and local changes in the mouth. Since the oral changes may occur very early in the disease, agranulocytosis is of special interest to dentists. Oftentimes, the early symptoms begin with an angina and superficially resemble those of Vincent's infection, which is etiologically different. Agranulocytosis is a comparatively rare though serious disease with a high mortality, which makes it of special concern to dentists. The incomplete disease is said to occur frequently and is less serious, but it may result in the complete agranulocytosis, which is almost invariably fatal. Since the disease is often coincidental with a dental disorder, and is preventable or controllable within limitations, every dentist is likely to be confronted here, at some time or other, with special responsibilities which extend beyond the scope of immediate technical procedure. For instance, the disease may follow the extraction of a tooth. It is the purpose of this report to summarize the essential features of agranulocytosis and assess the causal and therapeutic relationships in the light of data available at present.

Agranulocytosis is a comparatively new disease, having been first described only twelve years ago, by W. Schultz. It has achieved special prominence during the past two years owing to the report of Madison and Squier of Milwaukee, who incriminated amidopyrine as the chief causative factor. Since the appearance of Madison and Squier's report, more attention has been given to recognition of the disorder by the medical and dental professions, with the result that case reports are now steadily appearing in the literature. Probably Kracke, of Atlanta, has investigated the problem most extensively. His publications, which contain references to practically all reports published up to recent times, were freely used in compiling this report. A list of the reports used, arranged alpha-

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betically according to authors, is appended. To save space, references to authors by name have been limited to a few. The titles of the listed papers indicate the subject matter discussed for identification with the text of this report.

MANIFESTATIONS OF CLINICAL AGRANULOCYTOSIS

Agranulocytosis is manifested by the following signs and symptoms: lassitude, sudden onset of fever, chills, malaise, prostration and sore throat, in the early stages; ulceration and gangrene of the tonsils, tongue, gums and buccal membranes, which spread rapidly and may be confused with those of Vincent's infection. The blood picture clinches the diagnosis: the leukocyte count is reduced from a normal of 6,000 to 7,000 to 2,000 or less; while in Vincent's infection there is a leukocytosis, but the red blood corpuscles, platelets and hemoglobin remain normal. The polymorphonuclear leukocytes are characteristically reduced in number and lose their nuclear or granular appearance; whence the name "agranulocytosis." The polymorphonuclear leukocytes may disappear entirely, while the lymphocytes are relatively increased. The loss of the polymorphonuclear leukocytes impairs and finally destroys the most important defensive mechanism of the body against infection. Therefore, the later stages of the disease are frequently characterized by manifestations of some intercurrent disease, generally infectious, which ends fatally. The disease may run its full course rapidly, requiring only a few days or weeks. Children succumb generally in less than six months. Fluctuations in symptoms and blood changes are not uncommon, with periods of apparent recovery. Periodic or recurrent agranulocytosis has been recently discussed by Kitchin. There is a tendency to chronicity in some persons, and it is in these cases that the organisms of Vincent are common and present diagnostic difficulties. Treating Vincent's infection in such cases gives temporary relief, but does not arrest the periodic occurrence of fever and agranulocytosis. If the immediate cause is eliminated, recovery from agranulocytosis may occur rapidly and completely, but if the cause continues to act, a steady decline of the patient's health and ultimate death are inevitable.

CAUSES

Apparently, about 500 cases of agranulocytosis have been reported in this country and Canada and about 400 in Germany. The number in all other countries appears to be comparatively insignificant. The disease is virtually unknown in Russia and in the Orient, and is comparatively rare in England. This suggests peculiar and specific, but not racial, causes. It is about twice as common among females as among males. The distribution of cases favors the professional classes, especially physicians and their families, dentists, nurses, medical students and technicians. This peculiar predilection indicates some selective, professional or occupational cause. This, together with the fact that the vast majority of cases have occurred in countries of extensive chemical industry and drug exploitation, suggests that the cause may be associated with some chemical substance.

Antipyrine.—Although agranulocytosis is a clinicopathologic entity of unknown etiology, belonging to the group of blood system diseases, it is interesting to note that one of the commonest immediate causes of the syndrome is claimed to be use of the drug amidopyrine or its parent substance, antipyrine. This drug was identified by Madison and Squier as a parallel causative factor in their cases. It is widely exploited in secret nostrums and nonsecret proprietary products for headache, toothache, neuralgia, arthritis, dysmenorrhea and the like, owing to its analgesic properties. It is frequently a constituent of about thirty proprietary mixtures, such as allonal and peralga, the other constituent being commonly a barbital and less commonly a salicyl compound or cinchophen. The wide distribution of free samples of these products in dosage forms to the medical, dental and allied professions correlates with the selective distribution of the disease.

The therapeutic efficacy of these products has led to a fairly extensive usage among the laity, as the result of medical and dental prescribing and counter prescribing in drugstores. An unprotected public is the victim of practices resulting from ignorance of the proper use of drugs and from commercial exploitation. It must be said for the dental and medical professions that many years of legitimate usage of antipyrine and its derivative, amidopyrine (pyramidon), by hundreds of thousands of people throughout the world, failed to cause any disturbance of the people's health. Least of all, there seems to have been agranulocytosis as a possible cause of decreased resistance to infectious disease. Statistically, the morbidity and mortality rates have steadily decreased during this period of uncontrolled exploitation. Furthermore, the millions of blood examinations of people in all walks of life, made during these many years by specialists, physicians, medical students and assistants, in private practice and in numerous institutions throughout the world, have also failed to reveal the common existence of this disease, despite widespread medication over many years. Are these circumstances to be regarded in the light of a stupendous diagnostic failure, or, after all, is antipyrine of no etiologic significance in agranulocytosis? Do they merely confirm the rare nature of the disease, which may develop under only unusual and specific conditions? A review of the evidence at hand does not permit as yet a conclusive answer to these questions, but an appraisal of the claims and data is in order in view of the serious nature of this syndrome.

There are at least a dozen clinical case reports in the literature which point to amidopyrine or antipyrine as the chief causative agent in agranulocytosis. It is not always clear whether the amidopyrine is regarded as a contributory, or as an intrinsic, fundamental factor. Nor are the majority of these reports convincing of the action of amidopyrine in the absence of critical consideration of accompanying events and disturbances. While it is true that Madison and Squier stressed the use of amidopyrine as the parallel event in their cases, the exclusive, or even the predominant, causal rôle cannot be assigned to this drug. Sensitiveness in certain persons rather than a universal action of this drug is a possible explanation of any undesirable reactions.

Stewart and Kracke list seven groups of possible clinical causes of this disease, namely, a specific bacterium, abnormal menstrual states, certain anemias, sequels to leukopenic diseases, such as influenza, certain drugs, exhaustive physical and mental states, and certain senile states. As for drugs, protein products and toxins, more than twenty-eight different agents are reported in the literature, amidopyrine being the most commonly mentioned since the report by Madison and Squier. In this group, there are such diverse agents as radium, gold compounds, arsphenamine, mercury, bismuth, acetylsalicylic acid, hydroquinone, dinitrophenol, acridines (acriflavine), typhoid vaccine, toxins of streptococci and *bacillus Welchii,* quinine, antigen-antibody precipitin (anaphylactic shock), foreign proteins in general, ortho-iodoxybenzoate and a number of other coal-tar products, fumes of combustible gases and others which need not be enumerated. Barbital compounds are regarded by some as a possible causative factor, acting either directly or indirectly as potentiators for amidopyrine, as in allonal, but by others they are denied a positive rôle. Phenobarbital, which contains a phenyl group, the benzene ring portion of this drug, is used extensively as a hypnotic and sedative, and in the treatment of epilepsy for long periods; yet the barbitals are generally absolved as causal agents in agranulocytosis. Benzene (C_6H_6) can be depended on experimentally to injure the bone marrow and reduce the leukocytes of the blood and has some usefulness in the treatment of leukemia; but the occurrence of agranulocytosis is far too rare to incriminate this aromatic ring compound. From this variety of agents, physically and chemically different, there is no reason to believe that the benzene ring is especially concerned with agranulocytosis; which is contrary to theories advanced in its behalf. In fact, most of the incriminated agents are not benzene ring compounds. Amidopyrine is, of course, a pyrazolon derivative and not a benzene ring compound. Speculation on such close chemical correlation with the disease

is decidedly premature and not particularly helpful. Proescher and Empey describe a condition of idiopathic agranulocytosis of toxic origin, which is typical, but without mention of a specific chemical agent as the directly causal agent. In their case, the only identifiable noxious agent was exposure to fumes from a gas furnace for a period of three weeks and over twelve months prior to the development of the syndrome. Such remoteness of the suspected cause indicates that it acted indirectly, if at all. How these various agents would exert their actions is conjectural.

This leaves the etiology of the disease considerably in the dark. Therefore, it is justifiable to ask whether, or to what extent, the use of amidopyrine and other supposedly causative agents is a coincidence in the events culminating in the syndrome. It might be a contributory, or possibly an immediately excitatory, cause, in persons with hematopoietic systems weakened or injured by some more fundamental condition, or made unusually sensitive. This would account for the comparative rarity of the disease. Hence, it appears reasonable to regard agranulocytosis as an idiopathic disease of the myelogenous structures of unknown etiology, which is rare, but subject to sudden exacerbation by a variety of conditions, including the use of drugs and toxins of variable composition. The syndrome, in its gravest form, may be precipitated by a relatively insignificant condition or event; which should emphasize the need of the greatest vigilance in suspected cases, or in persons of known sensitivity to drugs and agents in general. It is possible that the condition is an allergic phenomenon.

EXPERIMENTAL ATTEMPTS AT REPRODUCTION OF THE SYNDROME

Since, under clinical conditions, the fundamental nature of agranulocytosis cannot be determined, the experimental demonstration of the same blood picture has been attempted, without success. At best, only fleeting blood changes have been produced with drugs and toxins in occasional animals. Until success is achieved, the cause of the clinical disease must remain an enigma. Particularly outstanding is the lack of experimental success with amidopyrine, which may be due to employment of the wrong animal, procedure or even criterion. This is quite evident from the fact that only one rabbit out of a group of nineteen may respond with blood changes resembling agranulocytosis, as in the experiments of Madison and Squier. Kracke and Parker report failure to produce granulopenia in rabbits treated with a number of drugs, including amidopyrine. Very large, and apparently toxic, doses of the oxidation products of some of these drugs, namely, quinone and catechol, which these authors incriminate, caused only variable or equivocal changes in leukocyte counts in some animals. For instance, the protocol of an experiment with catechol, which they quote, shows first a leukocytosis for eight days and then a leukopenia for six days, followed by death. The condition of these experiments did not correspond to the clinical. Other investigators report the same lack of success, not only with rabbits but also with other species.

K. D. Miller claims that amidopyrine causes bone marrow changes in dogs, consisting of a decrease in number, or complete absence, of granulocytes, with increase in the number of young undifferentiated cells; which is regarded as a suppressed maturation of hematopoietic elements. It is significant that Miller finds no reduction in, or disappearance of, granulocytes from the circulation, which is a characteristic sign of clinical agranulocytosis. Moreover, the doses of amidopyrine used by Miller are excessive, bordering on the toxic, and would be clinically unattainable without serious consequences, such as collapse. The doses used were the equivalent of 21 gm. for a 70 kg. (154 pound) man. The drug was given daily for at least one month, which would make a total consumption of about 588 gm., or more than 1 pound, of amidopyrine. If the equivalent span of human life, which would be about eight months, is taken into consideration, the total consumption of amidopyrine by the same man would be more than 9 pounds, which is almost certain not to be achieved in clinical practice. Nor is there any reason to be-

lieve that anything approaching such a quantity of amidopyrine was ever taken by the patients of the current clinical reports on agranulocytosis. All of this merely shows that amidopyrine may be capable of producing the bone marrow changes that Miller reports, as indeed might excessive quantities of other agents, but that these conditions have no necessary connection with the classical clinical agranulocytosis. It is possible, of course, that Miller's procedure of examining the bone marrow, rather than the peripheral blood, may eventually lead to the discovery of the fundamental cause, and also that preliminary sensitization (altered states, anaphylaxis, etc.) or injuries with toxic agents may reproduce the syndrome. The referee is informed of other experiments in progress on dogs which seem to indicate that gastric administration of very large doses of amidopyrine for many months can reduce the polymorphonuclear leukocytes in the blood, but these experiments are to be confirmed and extended before definite conclusions can be drawn. It is certain that, until the disease is reproduced experimentally, confusion as to its etiology and pathology, and also rational treatment, will continue.

TREATMENT

Such treatment as has been used is largely symptomatic and expectant. Removal of the suspected cause at once is, of course, indicated, but this will not be sufficient in frank or advanced cases with a marked or progressive neutropenia. Pentnucleotide (N.N.R.), which consists of the sodium salts of pentose nucleotides, is said to restore the nucleated leukocytes. It is injected intravenously or intramuscularly in doses of from 10 to 20 c.c., repeated twice daily, until the blood picture returns to normal. The reactions to the intravenous injection are similar to those of other foreign proteins or colloids injected intravenously, namely, fever, chills, dyspnea, sweating and tremors. Reich and Reich deny beneficial effects from pentnucleotide *per se* and regard the reported benefits as a mere coincidence, for, in carefully controlled animal experiments, regeneration of blood cells occurred equally readily after injection of physiologic sodium chloride solution (presumably, a 0.9 per cent sodium chloride solution).

The use of adenine sulphate is reported by Reznikoff to have been successful in uncomplicated cases of a granulocytosis, but not in severely complicated cases. Administration of 1 gm. intravenously three times daily is advised, and up to a total of 10.4 gm. can be given without ill effect.

Liver extract, equivalent to 300 gm. of liver by mouth and from 100 to 200 gm. taken hypodermically, is claimed to have been used successfully by W. B. Martin. V. Bonsdorff regards it favorably as an adjuvant. High voltage roentgen therapy has been tried with alleged success by Benjamin and Biederman.

Roberts and Kracke assert that they have used all these measures, and also foreign proteins and transfusions, to no avail.

Supporting and restorative measures should be used to maintain the life and strength of the patient, such as good nursing and diet, control of fever, and care of the skin, throat, teeth, etc. Oral and dental antiseptic washes are of no avail, except as they may afford temporary relief by mechanical removal of septic materials. Mild cases tend to recover spontaneously, and expectant therapy, therefore, merely provides the time, comfort and good hygiene while the recovery process is going on. If allergic manifestations are present, these may be controlled with epinephrine or atropine in the usual manner. In any case, the patient should be put under a physician's care as soon as the condition is suspected or diagnosed.

The progress of the case may be followed to some extent by determining the leukocytic reaction to intramuscular injections of from 0.2 to 0.5 c.c. of turpentine. Formation of a chemical abscess is said to be positive evidence of the myelogenic function of the bone marrow and the prognosis may be favorable. But if an abscess fails to develop, the myelogenic potentialities of the bone marrow are said to be lost and the prognosis is

grave. Intracutaneous patch and passive transfer tests have given negative reactions and are of no value in diagnosis or prognosis.

It is clear that, as long as the etiology of agranulocytosis is not understood, the medical treatment must remain empiric and unsatisfactory. None of the above mentioned measures can be depended on, but all or any one of them may be tried. For the present, the use of preventive or prophylactic measures, and avoidance of all suspected or contributory causes, as by control of the sale and distribution of secret proprietary mixtures containing antipyrine or amidopyrine with barbital, cinchophen or salicyl compounds and the like, offer a possible hope of reducing the incidence of this disease. The following products, which are known to contain antipyrine or amidopyrine, should not be used or prescribed indiscriminately by dentists, and patients should be cautioned against using them:

Allonal—Hoffman-LaRoche, Inc.
Alphebin—Gane & Ingram, Inc.
Amarbital—A. W. Kretschmar
Amido-Neonal—Abbott Laboratories
Amidophen—Eli Lilly & Co.
Amifeine—McNeil Laboratories, Inc.
Am-Phen-Al—G. S. Stoddard & Co.
Ampydin—National Aniline & Chemical Co.
Amytal Compound—Eli Lilly & Co.
Benzedo Compound Capsules—Abbott Laboratories
Cibalgine—Ciba Co.
Cinchopyrine Tablets—Abbott Laboratories
Compral—Winthrop Chemical Co.
Cook Analgesic Tablets—Cook Laboratories, Inc.
Dysco—Abbott Laboratories
Gardan—H. A. Metz Laboratories
Gynalgos—John Wyeth & Brother, Inc.
Hexin—Hexin, Inc. (Recent advertising asserts that Hexin contains acetylsalicylic acid, 2.45 grains, and antipyrine, 2.55 grains.)
Ipralidon (now called Ipral-Amidopyrine)—E. R. Squibb & Sons
Kalms—Johnson & Johnson
Lumodrin—Winthrop Chemical Co.
Midol—General Drug Co.
Mylin—Mifflin Chemical Corp.
Neonal Compound—Abbott Laboratories
Neurodyne—Chicago Pharmacal Co.
Nod—Reader Drug Co.
Optalidon—Sandoz Chemical Works
Peralga (Veramon)—Schering & Glatz
Phenamidal—Upjohn Co.
Pyraminal—H. A. Metz Laboratories

None of these products have been accepted by the Council. Reports were recently published on allonal and peralga. It follows that antipyrine and amidopyrine should be used with a full knowledge of their suspected relationship to the onset of agranulocytosis.

CONCLUSIONS

1. In view of the recent developments concerning agranulocytosis, a great responsibility devolves on dentists in procuring case histories and in the diagnosis of cases presented for dental care or treatment, especially cases suspected of medication with analgesic drugs and related symptomatic measures.

2. It is in order for dentists, in fact, they would appear obligated, to make routine blood examinations, at least white cell counts, in patients receiving the incriminated drugs or their cogeners, regardless of any final decision as to their relationship to, or the etiology of, agranulocytosis.

3. Although agranulocytosis is a rare disease, it may be obscured by, or confused with, Vincent's infection, which is comparatively common, but of different etiology.

4. Clinical agranulocytosis has not been reproduced experimentally and it remains a disease of unknown etiology although many extraneous conditions, including physical, chemical and bacterial agents, may usher in the syndrome.

5. Treatment of agranulocytosis is largely symptomatic and expectant and unsatisfactory. After elimination of the suspected cause, administration of pentnucleotide, adenine and liver extract, and irradiation, may be tried, together with hygienic and dietary measures and complete rest, but without promise of success.

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PRO-THESIA—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Inquiries have come to the Council on Pro-Thesia (Professional Products Company, Los Angeles, Calif.) On the label, Pro-Thesia is stated to be a "Topical Anesthetic for Dental Surgery. Safe, Non-Toxic, Non-Irritating, Odorless and Tasteless."

Circular material states that "PRO-THESIA is a solution of Ethyl-Aminobenzoate, a powerful Non-Toxic, Non Irritating Anesthetic, which when held in contact with oral

tissues, produces anesthesia by absorbtion [sic], the degree and duration depending on the length of time of the application."

It is said to anesthetize the area for puncture of a hypodermic needle and lancing of abscesses, in periodontoclasia, before taking an impression or grinding teeth, to desensitize dentin previous to cementing inlays or jacket crowns, to desensitize deep cavities, to prepare gingival cavities, etc.

In order to give the proprietors an opportunity to place the composition of this product on record, an inquiry was directed to the firm. After some time, the following statement of semisecret composition was received: "Only active ingredient twenty-five per cent (25%) Ethyl Para Amino benzoate. We regret that at present we cannot disclose the method of concentrating the solution."

Accordingly, Pro-Thesia was examined in the A.D.A. Bureau of Chemistry. The Chemist's report and the conclusions of the Council follow:

One (1) original package of Pro-Thesia (Professional Products Co., Los Angeles, Calif.), price, $2.50, was received for examination.

The bottle contained 28 c.c. (approximately 1 fluid ounce) of a light straw-colored liquid with a slight aromatic odor. It had a specific gravity of 1.048 at 20 C. and a refractive index of 1.4595 at 20 C.

Qualitative tests indicated the presence of ethyl aminobenzoate and a liquid with the properties of carbitol.

Quantitative determination yielded the following: Nitrogen (N), 1.39 gm. per hundred cubic centimeters.

From the foregoing, it can be concluded that a product having the essential properties of Pro-Thesia may be prepared by dissolving 16.5 gm. of ethyl aminobenzoate, U.S.P., in carbitol to make 100 c.c.

From the chemist's report, it is apparent that Pro-Thesia presents little originality, and that dentists are being asked to use a well known local anesthetic under a meaningless proprietary name, and at a cost greatly in excess of that required to produce it. (One ounce of Pro-Thesia, which sells for $2.50, can be made for approximately 10 cents.)

Pro-Thesia is declared not acceptable for Accepted Dental Remedies because the composition is not made available to dentists (Rule 1); the name is not expressive of the composition, and the firm is not entitled to a proprietary name for a mixture of well known substances (Rule 8).

At that time, the firm was informed that examination in the A.D.A. Bureau of Chemistry revealed that a product having the essential composition of Pro-Thesia could be prepared by dissolving 16.5 gm. of ethyl aminobenzoate, U.S.P., in carbitol to make 100 c.c. and that Pro-Thesia was held unacceptable for A.D.R. because the composition is semisecret, the name does not express the composition and, according to the rules of the Council, a proprietary name for a mixture of well-known substances could not be conceded by the Council, and that a report would be published in THE JOURNAL.

A telegram signed by S. B. Moss, for the Professional Products Company, expressed a desire to comply with the rules of the Council, and at the same time requested postponement of publication of the report. A threat was implied in the firm's telegram as follows: "Insist that you shall not publish any matters causing us damage and leaving us no other alternative if done but to protect our definite legal rights." In reply to this telegram, the firm was provided with a copy of the rules of the Council and explanatory comments thereon in May, 1933. The firm was advised that the course of the Council would be dictated by the interests of the dental profession.

The receipt of this letter was acknowledged by a representative of the firm. Meanwhile, a letter was received from a firm of attorneys which, on the whole, contained nothing more than quibbling. The firm of attorneys was also provided with a copy of the rules of the Council. In view of the circumstance that this product is being sold to the

dental profession, that inquiries are being received concerning it, and that the firm has taken no steps to make the product acceptable in the twenty-one months which have intervened, this report is published for the information of the dental profession.

SEDOBROL—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Sedobrol, put out by the Hoffmann-LaRoche Chemical Works, Nutley, N. J., was the subject of a report by the Council on Pharmacy and Chemistry of the American Medical Association in 1915. At that time, the Council on Pharmacy and Chemistry held the product not acceptable because "it is unscientific, because its use is likely to mislead both patient and physician into useless and pernicious medication."

Sedobrol is now being advertised to the dentist as a "unique method of administering bromide." It is stated: "In the patient's eyes Sedobrol is simply a delicious bouillon. Only the physician knows that it contains a valuable therapeutic aid—sodium bromide, 17 grains to a cube made of vegetable extractives."

The firm urges that Sedobrol be tried for: "Restlessness, hysteria, nervous indigestion, nervous headache, migraine, sickness of pregnancy, dysmenorrhea, menopause, sea-sickness, alcoholism, morbid excitability, sexual hypersthenia, insomnia, epilepsy."

Many of these symptoms and conditions are without the scope of dental therapeutics. It is no doubt advertised to the members of the dental profession in the hope of its being used for such conditions as may come within their scope.

Sodium bromide may be used when indicated in dental practice as a nerve sedative and for quieting nervous excitability, in cases of neurasthenia and hysteria connected with dental practice. Because of its effectiveness in controlling convulsions, of either cerebral or spinal origin, it has been used for epilepsy. The treatment of epilepsy is a fruitful field for the exploiter of sedative mixtures.

It is suggested that Sedobrol be used, in addition to definitely neurotic cases, for "the tired office worker, the school-teacher, the weary housewife, the bridge-fan, restless elderly people, the overly jovial clubman, those with nervous indigestion, those suffering from after-effects of influenza or a hard cold, in fact, for any sort of nervous fatigue." It is recommended to be taken in a cupful of hot water.

The foregoing makes it evident that a large dose of bromide is to be employed in the guise of a "cup of bouillon" and the name of the preparation further carries out this deceit. This means encouraging self-medication with a powerful and noxious product. The wide range of its claims stamps the recommendation as reckless, ill-advised and decidedly objectionable.

The claim now, as then, that the use of this preparation has increased the number of cases of cure in epilepsy is preposterous.

The Council holds Sedobrol "Roche" unacceptable for A.D.R. because it is unscientific, it is advertised with unwarranted and misleading therapeutic claims and its use is likely to mislead the patient and the dentist into useless and pernicious medication.

MORE MISBRANDED DENTAL NOSTRUMS

Benetol Tooth Cream.—Benetol Products Co., Redondo, Calif. Composition: calcium carbonate, soap, glycerin, salicylate and water, flavored with anise oil. Claims for

"protection against bacteria that attack teeth and gums" were false and fraudulent. (Notice of Judgment 18452, issued March, 1932.)

Pyro Sana Tooth Paste.—Alhosan Chemical Co., St. Louis, Mo. Composition: calcium carbonate, creosote and glycerin. Claims for pyorrhea, bleeding gums, etc., were false and fraudulent. (Notice of Judgment 18455, issued March, 1932.)

Gumtone.—Ellis-Jones Drug Co., Memphis, Tenn. Composition: iodine, salicylic acid, phenol, a zinc compound, chloroform, camphor, thymol and formaldehyde. Claims for treatment of pyorrhea and trench mouth were false and fraudulent. (Notice of Judgment 18458, issued March, 1932.)

Zhongiva.—John H. Wood Co., Philadelphia, Pa. Composition: zinc chloride, extracts of plant drugs, clove oil and methyl salicylate, glycerin, alcohol and water, colored with red dye. Claims for treatment of pyorrhea, painful erupting third molars, stomatitis, pyosis, incipient pyorrhea, interstitial gingivitis, pericementitis, peridental inflammation, pyogenesis, etc., were false and fraudulent. (Notice of Judgment 18462, issued March, 1932.)

Muco-Solvent.—McKesson Van Vleet Ellis Corporation, Memphis, Tenn. Composition: salicylic acid, extracts of plant drugs, glycerin, alcohol (29.07 per cent) and water. Claims for its use as a germicidal gargle were false and fraudulent. (Notice of Judgment 18468, issued March, 1932.)

PX.—PX Products (Inc.), Detroit, Mich. Composition: sodium chloride, aluminum chloride, zinc sulphate and water. Claims for "protection and healing of Mouth-Throat-Nose affections" were false and fraudulent. (Notice of Judgment 18470, issued March, 1932.)

Gilbert's Oral Antiseptic.—Gilbert Products Corporation, Morristown, N. J. Composition: phenols, including creosote, anise oil, sugar and water, colored with a red dye. Claims for pyorrhea, tender and bleeding gums, Vincent's infection were false and fraudulent. (Notice of Judgment 18477, issued March, 1932.)

Arex.—Arex Products Corporation, Brooklyn, N. Y. Composition: aspirin, caffeine, charcoal, a bismuth compound, cornstarch and talc. Claims for "Aches and Pains" were false and fraudulent. (Notice of Judgment 18479, issued March, 1932.)

Ward's Antiseptic Tooth Paste.—Dr. Ward's Medical Co., Winona, Minn. Composition: calcium carbonate (29 per cent), talc (9 per cent), glycerin (20 per cent) and water, flavored with peppermint oil and sweetened with glycerin. Claims for use as an antiseptic tooth paste to harden the gums and counteract the causes of decay were false and fraudulent. (Notice of Judgment 19658, issued February, 1933.)

San-I-Cide Mouth Wash.—La Pompadour (Inc.), Minneapolis, Minn. Composition: formaldehyde, zinc chloride, glycerin, alcohol (by volume 8.3 per cent), and water flavored with cinnamon oil and colored with a red dye. Claims for use as an antiseptic mouth wash were false and fraudulent. (Notice of Judgment 19657, issued February, 1933.)

Lar-Io-Ben.—Marvell Pharmacal Co. (Inc.), New York City. Composition: sodium chloride, iodides, benzyl alcohol, and gallic acid, glycerin and water, flavored with vanillin. Claims for use as a concentrated antiseptic for nose, throat, and mouth were false and fraudulent. (Notice of Judgment 19668, issued February, 1933.)

Pyo-Rem.—Pyo-Rem Chemical Company, California. Composition: zinc chloride, potassium chlorate, alcohol, water, boric acid, chloroform, formaldehyde and volatile oils, colored with a red dye. Claims for treatment of pyorrhea, etc., were false and fraudulent. (Notice of Judgment 19672, issued February, 1933.)

LeMercey Mineral Water.—LeMercey Sales Corporation, Inc., LeMercey Co. (Inc.), Calif. Composition: 0.24 per cent dissolved mineral matter, chiefly sodium chloride. Claims of curative or therapeutic value were false and fraudulent. (Notice of Judgment 19853, issued May, 1933.)

Salie's Canker Remedy.—E. R. Littlefield, Rochester, N. H. Composition: extracts from plant drugs including tannin, glycerin and water. Claims for treatment of sore throat, diphtheria, diarrhea, etc., were false and fraudulent. (Notice of Judgment 19854, issued May, 1933.)

Ectonal Dental Poultices.—Claymor Co., Brooklyn, N. Y. Composition: mixture of broken and powdered substances including red pepper, hops, belladonna leaves and acacia. Claims for treatment of toothache, abscess, congestion . . . of teeth and gums, etc., were false and fraudulent. (Notice of Judgment 19855, issued May, 1933.)

Painallay.—Painallay Co., Kansas City, Mo. Composition: cresol, glycerin and saccharin and water (98 per cent). Claims for treatment of all throat and mouth infections were false and fraudulent. (Notices of Judgment 19860, issued May, 1933; Notice of Judgment 19357, issued February, 1932.)

Tru Tablets of Aspirin.—Max Michaelson, Clarksburg, W. Va. Composition: 5 grains of acetylsalicylic acid each. Claims for treatment of coughs, acute rheumatism, sciatica, tonsillitis, etc., were false and fraudulent. (Notice of Judgment 19865, issued May, 1933.)

Jo-Vex.—Jo-Vex Chemical Products Co., St. Louis, Mo. Composition: calcium chloride, a compound containing available chlorine (0.07 per cent) and water. Claims for a "Proven treatment for Pyorrhea, tender or bleeding gums, trench mouth. . . ." were false and fraudulent. (Notice of Judgment 19869, issued May, 1933.)

Regum Tooth Paste.—Morgan & Sampson, San Francisco, Calif. Composition: calcium carbonate, glycerin, soap, zinc chloride and water flavored with aromatic oils. Claims that it would stop bleeding gums, prevent pyorrhea, etc., were false and fraudulent. (Notice of Judgment 19875, issued May, 1933.)

Pyros.—Pyros Co., Denver, Colo. Composition: dilute solutions of water, sodium chloride and zinc sulphate. Claims for "preventing decay of the gums and teeth," for stopping bacterial acid detrition in the first stages of tooth decay, etc., were false and fraudulent. (Notice of Judgment 19876, issued May, 1933. See also Notices of Judgment 18482, 18493, issued March, 1932.) (See also Report of the Council, THE JOURNAL 17:2302 [Dec.] 1930.)

Raysol Water.—Raysol (Inc.), Cincinnati, Ohio. "Analysis . . . Radium content one times ten to minus eleventh power grams per litre." Claims for the radium content as stated on the label were false and fraudulent. (Notice of Judgment 19880, issued May, 1933.)

Cadodyne Tablets.—Girard Pharmacal Co., Philadelphia, Pa. The article was labeled in part: "Cadodyne For Pain Each Tablet contains acetanilid 2 grs. . . ." It was alleged that the article was adulterated in that its strength and purity fell below the professed standard and quality, and misbranding was alleged for the reason that the statement appearing on the label was false and misleading. (Notice of Judgment 19886, issued May, 1933.)

Capsules Phenammo and Capsules Insulans.—Philadelphia Capsule Company, Philadelphia, Pa. Composition: (Capsules Phenammo) 2.363 grains of acetphenetidin each (Capsules Insulans) physiologically inert. Misbranding of Capsules Phenammo was alleged for the reason that the statement of composition on the label was false and misleading; misbranding of Capsules Insulans was alleged for the reason that the claims on the label were false and misleading, in that the capsules were inert. (Notice of Judgment 19892, issued May, 1933.)

Eson.—Pharmacy Products, Inc., Wilmington, Calif. Composition: phenol, iodine compound, glycerin, alcohol (3.7 per cent), water, colored with a red dye. Claims for treatment of conditions of the mouth, throat, burns, athlete's foot, etc., were false and fraudulent. (Notice of Judgment 19893, issued May, 1933.)

Indian New Discovery.—Justice Drug Co., Greensboro, N. C. Composition: chloro-

form, ether, ammonia, volatile oils, including camphor, turpentine oil, sassafras oil, alcohol and water. Claims regarding toothache, "And other Aches and Pains about the body . . ." were false and fraudulent. (Notice of Judgment 20151, issued June, 1933.)

Biz.—Henderson & Skipworth, San Francisco. Composition: phenol, camphor, and alcohol, 6.3 per cent. Claims for healing many local skin disorders were false and fraudulent. Misbranding was alleged in that it was stated to be safe while containing poison. (Notice of Judgment 20160, issued June, 1933.)

Lambert's Powder.—Lambert's Inc., Minneapolis, Minn. Composition: acetanilid (2.91 grains), acetylsalicylic acid (8.98 grains) and salol (2.42 grains). Claims for general relief of pain, etc., were false and fraudulent. Misbranding was alleged in that the wrapper stated: "Positively Do Not Contain . . . Or any Other . . . Or Injurious Drugs." The article contained acetanilid, an injurious drug. (Notice of Judgment 20161, issued June, 1933.)

Sinapole Ointment.—Sinapole Co., Los Angeles, Calif. Composition: petrolatum base containing volatile oils including mustard oil, 12.5 milliliters per hundred grams. Claims for treatment of "Sore throat . . . Toothache" "Neuritis," etc., were false and fraudulent. (Notice of Judgment 20164, issued June, 1933.)

Arium.—Fuller-Morrison Co., Chicago, Ill. Composition: tablets containing in each, 2.6 millimicrograms of radium and 0.02 mg. of strychnine. Misbranding was alleged in that the presence of strychnine was not made known on the label, and the directions for use were false and fraudulent, since a six weeks' course of treatment might be detrimental and dangerous. (Notice of Judgment 20168, issued June, 1933.)

Sodium Phenobarbital Tablets.—American Pharmaceutical Co., New York. Composition: phenobarbital sodium (0.97 grain per tablet). The bottle label and carton stated: "1½ grain Sodium Phenobarbital." Claims for the content of the tablets were false and fraudulent. (Notice of Judgment 20169, issued June, 1933.)

Brander's No. 7.—Haley M-O Co., Geneva, N. Y. Composition: soap, phenols, glycerin and water (99 per cent). Claims for use as a mouth wash and deodorant, and other antiseptic claims were false and fraudulent, inasmuch as the product was not antiseptic when diluted with an equal volume of water. (Notice of Judgment 20171, issued June, 1933.)

PYCOPÉ TOOTH POWDER

In the January issue of THE JOURNAL, pages 143 to 148, were reported abstracts of Notices of Judgment for various violations of the Food and Drugs Act of 1906. Among those products was listed, for violation of the Act in 1932, the product passing under the name Pycopé. It was also pointed out that, since that seizure, the composition of the product had been changed and the product submitted to the Council and found acceptable.

In one sense, this illustrates the concrete value of the work of the present Food and Drug Administration and the value of publicity which accrues from such findings.

Pycopé Tooth Powder was made acceptable in January, 1933, and its marketing since that time has been in agreement with the provisions of the Council for dentifrices. It is therefore listed among those dentifrices acceptable to the Council.

BUREAU OF PUBLIC RELATIONS

BEHAVIORISM: PRIVATE PRACTICE AND INSTITUTIONS*

By H. H. BURKART, D.D.S., Northville, Mich.

CHILDREN'S dentistry today is a combination of the jeweler's technical skill, the physician's knowledge of the healing art and the psychologist's understanding of human nature.

When one speaks of behavior, as pertaining to the child patient, he has in mind the child's reaction and attitude from the time he enters the reception room until his departure. When a child enters an office for the first time, it is with doubt, combined frequently with a fearsome, yet, with rare exceptions, a cooperative attitude of mind. Picture the small patient coming to the office. He enters a strange room, meets strange people and watches as another patient is being dismissed. It is wise to eliminate as much of strangeness as possible and make everything new appear pleasant and interesting.

It is advisable to have the reception room as suggestive of home as possible. The pedodontist can make all his plans to this end; the man in general practice can accomplish a great deal by devoting one corner of the room or, if possible, a specially built nook with small chairs and table to the interest of the small patient. I have seen very commendable effects obtained by stenciling characters and nursery rhymes on the walls of these nooks. Here, young eyes are greeted with the familiar characters of Mother Goose fame. These will form a connecting link with the home and school, where there are no end of books containing these same characters. Rooms devoted to play have, in my opinion, no value. They are an added burden to the assistant, and when we consider the possible results of allowing children in all conditions of health and cleanliness to play with the toys, their advisability seem remote.

One should make certain that all conversation with the patient being dismissed is cheerful in the waiting room and that the next patient is greeted pleasantly. He should be made to feel that he is the center of attraction. The assistant should greet the child by his first name and here again some of the strangeness is eliminated. A child does not stand on formality and he accepts with comfort and security the fact that he is known.

As for his reception into the operating room, the dentist follows exactly the same method. Undoubtedly, the child may be more reluctant to accept the operator, and it is here that the individual handling of the child patient is begun. The first step is again to eliminate strangeness and make things appear familiar and friendly.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

In my own office, I keep as much of my equipment out of the operating room as possible. A child's vivid imagination may create frightful instruments of torture out of some harmless object that is unfamiliar to him.

I believe that an operating stool is an ambassador of friendship. By sitting on it, I bring the child patient and myself on a level, and I am no longer a big bulk of a man towering above him. Seated beside me, he is more apt to enter into a conversation. Once we get a child talking, we have cemented the first bond of friendship.

With the new patient, considerable explanation is required. While this will take a few minutes the first time, it will save considerable time later. Seated beside the patient, after ascertaining which tooth hurts, I proceed to explain the use of the various instruments, comparing them with things with which he is familiar, such as mirrors, toothpicks, a hoe, shovel, squirt gun and air like daddy puts in his tires. In my office, we do not use the words drill and bur. For our child patients, we prefer to call them scrapers, and to demonstrate, with the engine running we apply a cross-cut fissure to the finger nail and let the patient observe the scrapings. He is told that the same thing happens to the tooth, scraping away the decay, only that it makes more noise in the head, and that occasionally it gets warm and hurts. He is admonished to let me know when it gets warm so I can stop and let the tooth cool off. With this short explanation, I now begin the preparation. I endeavor to make the first visit as well as each succeeding one productive. A prophylactic treatment, care of an aching tooth or the insertion of a small filling permits charging a fee.

As far as the reception is concerned, all children are treated alike, but from the time the child enters the operating room and is cordially greeted, our procedure must necessarily be guided by the temperament and behavior of that particular child on that particular day. In other words, there is a variation in behavior from day to day in any type of child. The procedure is something acquired from experience and by the application of common sense.

There are a few outstanding types which are constant. Let us consider these types:

John W., aged 5, recalls an unpleasant visit to a dentist, where he was mishandled, and he has overheard thoughtless conversations at home. He has suffered for several days with a toothache, but has made no complaints. Finally, when the pain becomes unbearable and he complains, he is persuaded to visit the dentist. Possible relief from pain has persuaded him to "take a chance." He enters the room with half a spirit of cooperation, when he spies the dentist, whom he met a few weeks ago, while out with his father, and to whom he was introduced somewhat like this, "Don't you know this man, Johnnie? He's the man that pulls your teeth." Immediately he associates the dentist and his father's remarks, and his fears are increased and he presents the problem of the frightened child. He requires a great show of kindness and understanding. Detailed explanations must be gone into, and evidence that it is not all hurt and that he is going to realize the benefits of what we do must be impressed on his mind. Encouragement and complimentary remarks for cooperation help considerably, while censoring for lack of cooperation should be done accordingly. He must be convinced of our honesty and desire to play square.

Diane M., aged 4 years, comes into the office willingly, but when spoken to clings to her mother's dress and hides her

face. She is not frightened. She appreciates our attention, but does not know exactly how to reciprocate and shrinks from our notice as much as possible. She is shy and bashful, but once we can get her interested and conversing, we have won her over and she will prove a very desirable and cooperative patient.

Shirley A., aged 6, is the youngest child and only girl in a family of four children. She is the "boss" at home, always getting what she wants because the parents, rather than listen to her tantrums, give in. She is far from bashful, is not shy nor frightened, but nevertheless comes in crying and proceeds to display her temper. Her crying has always brought the desired results and she sees little reason why it won't work in the dental office. This type is best handled by sharp reprimand, and the parent or attendant must be excluded from the operating room. During the first few visits, frequent censoring will be necessary. This should be flavored with kindness whenever possible. Nevertheless, this type must be kept at "arm's length," so to speak, at all times, and a firm and reserved attitude must be maintained by the dentist. Before long, little Miss Shirley has concluded that your office is one place where she doesn't get everything she wants just when she wants it. This understood, she makes a very satisfactory patient, and her parents too will admire and respect you for accomplishing something that they seemingly are unable to do.

Then there is the type represented by George B. He is 8, the recognized leader of his neighborhood group and a source of considerable annoyance to his school teacher. He informs you with no little doubt in his speech that he doesn't intend to let you "fix his teeth." This type must be met at his own game and treated accordingly. I actually enjoy working with this type as to me it is like a game. He is either going to give in to me or I to him and I have no intention of the latter. In just a few minutes, he can be convinced orally that you intend to proceed with the work and he can choose whether it is going to be done pleasantly or unpleasantly. If you start work immediately, you have called his bluff, for in reality that's what it amounts to, and when he understands that you mean what you say, he responds at once, and really becomes a very worth while patient.

The dentist, to be successful in handling children, must be reserved and firm, yet honest and understanding of the child's emotional reactions.

Average normal institutionalized children are very much like all other kinds of so-called normal children. This means that average dependent children show the same individual characteristics and fall into the same general groups of classifications as other types of children. They show the same components of personality-intellectual levels, emotional disturbances and volitional urge of achieving desired ends. But while the general classifications are the same, it is also true that the ratios of these different personality traits are different in quantity and intensity among normal dependent children and normal independent children selected from the community at large. Children who have lost their parents, children who have been neglected by their parents, children who have been maltreated by either ignorant, unsympathetic or mentally diseased parents, children who have suffered all the heartaches and emotional pangs that accompany the tragic breaking up of a home and the tragic separation of the child from his home and parents, show deep emotional scars on their personalities, and it is only natural that, as a result, these same children cannot and do not possess the same

emotional balance that other normal children have. Children who are undernourished or are afflicted with disease cannot have the same nervous energy or physical stamina that normal children possess. Unfortunately, many of these children who are emotionally unbalanced or have nervous or physical weaknesses become the average dependent children who need prolonged custodial care. These are the types we find in orphanages, hospitals and, for short periods, in detention homes.

As regards reactions to dental service, these types vary little from the independent child in private practice, with the possible exception that because they have been emotionally starved in their own homes, have received little if any sympathy and have been shunted from institution to institution, they are perhaps more fearful of results and their absolute confidence must be gained before much can be accomplished.

Now in addition to this group, of what we might call underprivileged children, we have others who are known to be semidelinquent or feebleminded.

For eight years, I have had the opportunity of working with this particular class of dependent children. The institution with which I am associated, the Wayne County (Michigan) Training School, is one expression of the tremendous social problems engendered by an almost unparalleled growth in a state undergoing coincidently almost a metamorphosis from a stable, largely rural commonwealth to a seething urban manufacturing state. In the period from 1910 to 1930, Wayne County, of which Detroit is the largest single unit, had grown from a population of 531,590 to 1,888,946. Fifty per cent of the increase in the entire state occurred in this one county out of all the eighty-three in the state. What was the result? As far back as 1922, the community suffering from all the social "growing pains" that accompany the doubling of a population into a million in ten years, found the problem of its community, the mentally defective, so vexing, that it adopted the pattern of a county institution for these defectives. Picture, if you can, the growth of business in this hectic postwar period. Detroit became a melting pot for all nationalities and classes. Marriages, intermarriages and socially unbalanced unions resulted in families—usually large families. The children in many cases were subnormal, but nevertheless of sufficient intellectual capacity to be self supporting provided their environment was changed. These are the types with which we have to work.

In this group are the children who, in private practice, would tax the patience of the dentist. They do present types which, if understood and treated accordingly, are to a degree responsive to dental care. In all cases, due consideration must be given to home training and environment. Invariably, there has been no attempt at home to take care of their teeth and, in many cases, the children have never owned a toothbrush.

A few predominating types: Jennie O., enters the operating room in an hysterical condition; primarily due to fear. She is timid and enters with an attitude of "Please don't hurt me" as she looks up pitifully. Her thoughts are confused and her expressions are contradictory. This type responds to kindness, but needs constant reassurance.

Anna K. is different. She is alert and has a pleasant manner. She is suspicious of your every move. She pays little attention to your reassurance. She is naturally cruel to other children and delights in scaring them when she knows they are going to the dentist. Nevertheless, if one can win the confidence of this type, work can be done satisfactorily,

as they readily attach themselves to those whom they trust.

Walter H. resembles to a certain extent the "bully" or incorrigible type found in private practice. He has a defiant attitude. He feels that he is being unjustly confined and will never be happy or contented, no matter what the duration of his confinement. Regardless of age, this type is disobedient, destructive and profane. He will not listen to reason, so one must make positive assertions and proceed with the work regardless of protest that he "isn't going to let you fix his teeth." Having the unpleasantness over at the first visit, with the patient fully understanding that we cannot be "bluffed," makes for pleasant future visits.

Notwithstanding the fact that the completed restoration must be above reproach, the child patient is not capable of evaluating the dentist's technical skill and knowledge. The final achievement in the child's mind depends essentially on the dentist's ability to relieve his anxiety and fear, and to overcome any lurid presumptions, which may have arisen from overheard conversations, that might, or might not, have a sound foundation. Ultimate success in the handling of children is dependent on one's ability to study each child as an individual.

Regardless of whether the child patient is in our private practice or an institution, let me stress the fact that if we can by our truthfulness and composure under all conditions get the child's confidence and friendship and yet maintain his respect by our firmness, we have laid the foundation for a pleasant and profitable association.

MORRIS HIGH SCHOOL AND THE DENTAL QUESTION

By MURRAY RAYBIN, B.S.S., M.A., D.D.S., New York City

THE institution of practical dental hygiene in the high schools of the City of New York is still to be realized. Through a slow and untiring process, elementary schools in the city have reached the point where dental clinics operate as an important factor in the schools. This phase of work has gained momentum to the extent that, at the present time, fifty additional clinics are contemplated. In the high schools, dental activities rely essentially on the leanings of the principals and progressive teachers. It would appear, therefore, that this work hinges on the importance and interpretation which is placed on it. Logically, two questions present themselves:

1. Is it the main function of the high schools to advance the educational studies of the pupils?

2. If so, is dental hygiene totally apart from the school curriculum? Is it something which might possibly be of benefit to the child, but which does not materially affect his capacity to learn the subjects requisite for educational promotion?

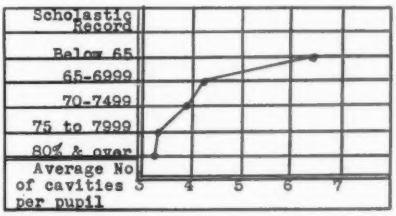
Certainly there is but one answer. Either this matter is important or it is not. Either the dental condition does affect the child or it does not.

SURVEY

Exactly to what extent the dental condition of the child affects his studies can

best be judged perhaps by figures and facts as revealed in an intensive survey of the question. It was possible for me to compile first hand information on the subject while employed as a biology teacher-in-training in Morris High School. There can be little doubt that this high school is among the more progressive schools in regard to dental hygiene. I found that such work was being carried forward constructively and intelligently, through the conscientious and diligent efforts of the teachers of hygiene, with the support and encouragement of the principal and of the head of the high school division.

To a dentist and teacher who sincerely wished to investigate the subject, to make a really exhaustive study and find out



Correlation between scholarship and freedom from dental decay.

just how much weight might honestly be placed on the dental question in regard to the pupil in the high schools, its effect on his studies, etc., such a sympathetic atmosphere was stimulating and encouraging. All channels were left open to me so that I might study them. I was permitted to take an active part in examinations of the pupils, to ascertain whether dental treatment were necessary. In the compilation of a chart of figures given below, which shows the correlation existing between the dental condition of the pupil and his school rating, I was able to see conditions at close range. I set out the figures as revealed by the survey and let them speak for themselves. (Tables 1-2.)

The foregoing figures are compiled from studies of the dental condition of children ranging in ages from 13 to 19 years, examined in February, 1934. In this survey are included not only my junior hygiene classes, but also the members of the graduating class. The figures would indicate that, of the 554 pupils examined, 509 have decayed teeth, which means that about 92 per cent of all pupils examined by me presented caries, while the average number of cavities per pupil is approximately 4.1. My findings are similar to those shown in surveys at Columbia University and elsewhere, which have revealed that more than 90 per cent of our students have at least one decayed tooth.

In studying the summary of the graduating class, it is illuminating to note that 8-1 and 8-2, which are the scholarship classes of the school, show an average of 2.7 cavities per pupil, while the seniors as a whole show 4.1 cavities per pupil. On the other hand, 8-9 and 8-10, which are the classes poorest in scholarship, present an average of 6.55 cavities per student. As the scholarship classes 8-1 and 8-2 showed a smaller number of cavities per pupil, it occurred to me to investigate the possible correlation between the actual scholarship marks of the pupils and the number of cavities in the class.

The present teacher-in-training cooperated with me in this direction, by placing on each individual dental examination blank the average scholarship rating.

The examination slips were sorted into five classifications as follows: those whose average marks were 80 or over; from 75 to 79.99, from 70 to 74.99, from 65 to 69.99, and those whose average marks

were below 65. The accompanying chart and Table 3 set forth my findings.

ROUTINE

Remarkable progress has been made by Morris High School along dental lines. There is little doubt in my mind that a 100 per cent rating is not possible only because of the lack of a dental clinic within the school. The chairman of the department of biology and hygiene has been doing all in her power toward the institution of a clinic, but the financial condition of the city at this time does not permit the expenditure. It is highly commendable, therefore, that, despite existing conditions, Morris High School has not permitted the dwarfing of the important issue of dental hygiene, but has gone forward actively and has done what it considers the next best thing in order to cope with the situation: It has established a very definite and progressive routine, which is earnestly and conscientiously carried through.

The first step is a preliminary examination of the teeth. The second step is a weekly examination following up the preliminary one. Thus, a continual operation for dental improvement exists in Morris High School.

METHOD

Of the 5,000 students attending Morris High School, about 3,000 have hygiene in their programs every semester, as a required minor subject. For graduation, the student must pass four terms of hygiene, and a pupil whose teeth are not in good condition cannot pass. In order to determine the dental condition of the students, the routine is as follows: At the beginning of the term, all the hygiene students are examined. Those students who need treatment are urged either to go to their private dentists or, if they cannot afford that, to say so in order that other arrangements can be made for their care. The presence of dental defects at the close of the term

Table 1.—Summary of Dental Examinations of Author's Junior Hygiene Classes as of February, 1934

Classes According to Day and Period	Total No. Pupils	No. Pupils with Cavities	Pupils with Cavities Per Cent	Total No. Cavities	Average No. Cavities per Pupil	No. Pupils Requiring Cleaning Only	No. O.K. at First	Pupils O.K. at First Per Cent
Mon.-6th	27	26	96	120	4.4	1	0	0
Mon.-8th	33	32	97	133	4.0	1	0	0
Tues.-5th	34	30	88	110	3.2	3	1	3
Tues.-6th	32	30	94	123	3.8	1	1	3
Tues.-8th	33	31	94	143	4.3	0	2	6
Tues.-9th	39	36	92	144	3.7	3	0	0
Wed.-6th	34	32	94	153	4.5	1	1	3
Wed.-8th	27	26	96	129	4.8	1	0	0
Thur.-6th	26	24	92	141	5.4	0	2	8
Thur.-8th	27	24	88	101	3.8	2	1	4
Thur.-9th	43	39	90	154	3.3	1	3	7
Fri.-6th	27	23	85	123	4.5	3	1	4
Fri.-8th	24	21	88	121	5.0	1	2	8
Total or Average	406 Total	374 Total	92 Average	1,695 Total	4.2 Average	18 Total	14 Total	3 Average

means failure for the term in hygiene. A definite date is set, usually about a month before the close of the school term. On or before the fixed date, all cavities must be filled, all roots and badly broken down teeth must be extracted and all tartar and stains must be removed, before the pupil can be passed in hygiene.

In the weekly examination, the teachers use rounded toothpicks to ascertain whether cavities are present. Quite often, when they have been in doubt, and expert knowledge and information have been required, they have referred pupils to me for examination.

(Size of slip—2½" x 5")

Last Name First Name Off. Class

Address

Parent's Name Date

Hyg. Teacher Hyg. Class

UPPER

L R

CENTRAL INCISOR
LATERAL INCISOR
CUSPID
1B
2B
1M
2M
3M

LOWER

L R

CENTRAL INCISOR
LATERAI INCISOR
CUSPID
1B
2B
1M
2M
3M

Once the condition is understood, recommendation is made for treatment. Nothing short of completion is considered sufficient to pass in hygiene, even if only the cleaning remains undone. Every cavity, no matter how minute, must be filled. Fillings of a temporary nature, such as temporary stopping and baseplate guttapercha, are not acceptable. Not infrequently, diplomas are held up until all necessary dental work is completed.

If the pupil has been told that he requires dental work, and a few weeks reveal no evidence of such work having been done, the parent is summoned to ascertain the cause of the delay, if the child can give no suitable explanation. To enforce this measure, the student is suspended from classes until the parent comes for an interview. When the latter does appear and the cause of the delay is known, steps are taken to have dental treatment begun. In these cases, the student is not admitted to class until the teacher can see the actual beginning of dental work in some form, if the parent is financially able to provide it.

I found that a very effective way of determining the progress of the dental work was to show on a printed slip the condition of the teeth when examined, to check off existing cavities, and then to note the progress. Such a system, which entailed a small printing bill, was a most inexpensive means of checking, and my recommendation for its use was enthusiastically received by Morris High School. I set it forth as of possible benefit to other schools.

OBSTACLES

To have professional dental work in active operation in the high schools would do away at once with a great many retarding elements. But with economic conditions as they are, work has to go on progressively despite many obstacles. These consist of a number of things: First, there is the element of inertia, with which Morris High School is coping very

capably. Then, there is the financial condition in the homes of a great many high school children who require dental attention.

A large percentage of these children come from homes that operate under home relief and receive aid from some charitable organization. Many others, who receive neither home relief nor institutional or private charity, come from homes barely able to supply the daily carfare to and from school. Investigation has shown that sometimes children are even obliged to walk long distances to school, unless aided by the teachers' welfare fund, or in some other way. Likewise, not a few children are forced to go without lunch unless they have some aid.

Often, these conditions do not come to light. In Morris High School, they have been revealed because of the insistence on dental improvement. Pride has prevented many a pupil from letting the actual financial condition become known to his teachers; and it is only when discipline is imposed for lack of dental cooperation, and still no results have been secured, that the pupil finally reveals the dire financial condition of the home.

Active help is open to the child who cannot afford a private dentist. The greatest help perhaps is to impress on him that it is consistent with self-respect to accept this help when his parents cannot give it to him. Information as to all sources of aid is made available to the student. In case the parents are summoned, and they reveal the lack of funds in the home, a friendly interview often opens the path for the dental improvement of the child.

TABLE 2.—SUMMARY OF DENTAL EXAMINATIONS OF JUNE, 1934
GRADUATING CLASS TAKING HYGIENE, AS OF FEBRUARY, 1934

Classes According to Official Section	Total No. Pupils	No. Pupils with Cavities	Pupils with Cavities Per Cent	Total No. Cavities per Pupil	Average No. Cavities per Pupil	No. Pupils Requiring Cleaning Only	No. O.K. at First	Pupils O.K. at First Per Cent
8-1	13	11	85	38	2.9	2	0	0
8-2	6	6	100	15	2.5	0	0	0
8-3	16	14	88	60	3.8	1	1	6
8-4	15	14	87	52	3.5	0	1	6
8-5	13	11	85	35	3.8	1	1	8
8-6	14	13	86	81	5.8	0	1	7
8-7	9	9	100	32	3.6	0	0	0
8-8	12	11	92	46	3.8	1	0	0
8-9	15	15	100	94	6.3	0	0	0
8-10	9	8	89	61	6.8	1	0	0
8-51	19	8	96	67	3.5	1	0	0
8-52	7	5	71	20	2.9	0	2	28
Total or Average	148 Total	135 Total	91+ Average	602 Total	4.1 Average	7 Total	6 Total	4 Average

DENTAL AIDS

Students over 17 whose parents are on home relief are taken care of by the state dental clinic (T.E.R.A.), which is now under the direct supervision of the home relief dental division. In addition to home relief cases, the children of many other families are cared for by the state dental clinic. These include recipients of aid from the A.I.C.P., Salvation Army, Jew-

ish or Catholic charities, Bronx Tuberculosis and Health Committee, Henry Street Settlement, C.W.A. Workers, Children of World War Veterans, patients of various city hospitals or those who are cared for by their social service workers, etc.

If the student cannot be taken care of through any of these channels by the state dental clinic, the child's parent is asked to see the school investigator, to explain the financial condition of the family. Every case is thoroughly and intelligently investigated as to family earnings, number of children, etc., and if worthy, each case is handled so that free dental care is given to the child as far as opportunity offers, that he may suffer no neglect because of the current economic depression. Such pupils are sent by "The Bronx Tuberculosis and Health Committee" to the offices of private volunteer dentists, who do the necessary dental work for these children without charge.

TABLE 3.—SUMMARY OF SCHOLARSHIP RATINGS IN RELATION TO DENTAL DECAY
(JUNE, 1934 GRADUATING CLASS, EXAMINED FEBRUARY, 1934)

Scholarship Averages as per Permanent Record Book	No. Pupils in each Scho'arship Group	No. Cavities	Average No. Cavities per Pupil
80 and over	23	72	3.13
75-79.99	31	98	3.16
70-74.99	49	192	3.92
65-69.99	30	124	4.13
Below 65	6	39	6.50
Total or Average	139 Total	525 Total	3.8 Average

CLASS ROOM INSTRUCTION

The importance of dental hygiene is stressed in the hygiene and biology departments. In my own classes, instruction was given as to the anatomy and function of the teeth, diet in relation to teeth, the requirements of a good toothbrush and dentifrice, methods of tooth brushing and related topics. Other topics are treated, such as the importance of the first permanent molar, why loss of a tooth is detrimental to dental and general health, the necessity of regular semi-annual visits to the dentist, progress of decay and other topics of dental health. Various colored charts and pictures obtained from Columbia University, dental magazines and other sources are shown, to illustrate the various points discussed.

CONCLUSION

There can be little doubt that the dental condition of the high school child does affect his health and therefore his ability to progress educationally. It is to be hoped that the high schools of the City of New York will very soon benefit from the actual installation of dental clinics within the schools. Barring that aid, there are still a great many avenues of activity open to them, and some of these activities have been demonstrated in the practice at Morris High School. Its worthy example surely deserves emulation.

INCOME TAX "DO'S AND DON'T'S"*

By E. H. VALENTINE†

HERE is a subject about which a million words may readily be written, and yet a member of the editorial staff of THE JOURNAL asks with great equanimity that the problems facing the professional man in the preparation of his income tax return be clearly and concisely stated for you. My answer was, "Clearly? Maybe!" "Concisely? But how?"

At best, the task of making the return we all dread to face, and we usually leave it until the deadline is just around the corner.

Please understand that the explanation is general. There are bound to be exceptions in certain cases. When you find yourself in this class, call the local Bureau of Internal Revenue and state your specific problem clearly and you will receive your answer, promptly and courteously.

Many people believe that because their net income is of a size that is not taxable, the filing of a tax return is not necessary. It is required that returns be filed by every single person who for the year 1934 had a gross income of $5,000 or more or a net income of $1,000 or more and of every husband and wife living together who for the year 1934 had an aggregate gross income of $5,000 or more or an aggregate net income of $2,500 or more. Widowers and married men separated from their wives by mutual consent are classed as single persons. If your wife (or husband) has a separate income, you may elect to make separate or joint returns.

Now let us turn to the forms used to make these returns. Please use Form 1040. It will not take long for us to run through it, step by step. If you are making out a joint return you must print the names of both the husband and the wife, otherwise print your name and address in those spaces designated at the top of the sheet. Now the next step is to answer those personal questions you will find in fine print directly under where you wrote your address. Next below, you will find the section devoted to income. Here, under item 2, you will place the amount of cash taken in during 1934 through the united efforts of yourself, your secretary and possibly a collection agent, and state that it was from your practice. Then if you were fortunate enough to receive interest on any holdings or investments, place those amounts in their respective places opposite either item 3 or 4. Opposite item 5 put in anything else you received, and explain it; likewise, under item 6.

How to arrive at these figures is best explained by turning momentarily to Schedule A, which should be filled in before you place any figures opposite the item under income. Under Schedule A, item 2 (labor) will include your laboratory bills or the cost of your own laboratory man. Item 3 covers your supply bills. Item 4 covers tooth brushes, pastes, powders, etc., bought by you and resold to patients. Items 5 and 6 should not bother

*Prepared at the request of the Editorial Office.

†Director, the National Service Bureau.

you, as other expenses will be covered under item 16 and very few dentists ever have an inventory (as such) on hand. If you do, list it. Now by addition and subtraction, arrive at the total necessary for item 9.

Hurrying on to item 10, list all salaries paid out by you to office assistants, scrub women, auditors, etc. If you have paid out interest during 1934 on any loans that you have incurred in the transaction of your profession, list the amount opposite item 11.

If you have kept your records so that you may prove up the figures used, you may now add the taxes you have paid on bank checks (business account), telephone conversations, cables, radio messages, telegrams and safe deposit box, provided all were business necessities, together with any tax paid your state on your income. Automobile license fees are ordinarily taxes and deductible. If you are practicing in a building devoted exclusively to your practice, include the taxes paid on this building, provided you are the one who paid those taxes. Place the sum total of the foregoing opposite item 12. Item 13 you will skip, ordinarily.

Those receivables which you have definitely proved uncollectable through the use of all known and recognized collection methods including collectors and law suits, together with the accounts placed in bankruptcy by patients, and all of which have been charged off your books during 1934, may be listed opposite item 14. But be sure you are able to show at any time that all the effort possible has been made to collect them, without avail.

It is generally conceded that the life of your equipment covers a span of ten years. Therefore, item 15 can carry an amount equal to 10 per cent of the cost of your equipment, provided you have not already charged off the entire amount in previous years.

Now list your yearly rental (paid), telephone bills, laundry bills, dues to dental associations, postage, printing, cost of reception room magazines, light and gas bills, cost of collections, cost of malpractice insurance and the cost of any entertaining done solely for the promotion of your practice (keep this list handy for a minute) and put the sum of these figures opposite item 16 under Schedule A.

Now again, by addition and subtraction, reach the figure necessary to be placed as item 19. This figure is the one you now place on the first page of the return as item 2 under income.

Turn back to page 2 again, and where it reads "Explanation of deductions claimed on Lines 5 and 16," write in the list which you were told above to keep handy and from which you obtained the total for item 16 under Schedule A.

Again we turn back to the first page and find that items 3-11 inclusive under income are self explanatory; likewise, item 12.

Under deductions, enter as item 13 interest paid on personal obligations not included as business obligations.

Item 14 includes taxes paid on real estate and personal property during 1934. Items 15, 16, 17 and 18 are all very clearly explained in the instruction sheet accompanying the tax return blank. Regarding item 17, be sure that you are in a position to prove conclusively any contributions listed.

Arriving at the figure necessary for item 20, you carry that figure down to item 21 and enter it there. Filling out items 22 and 23, if necessary, you arrive at 24. At this point, it is interesting to note that "a single person who supports in his home an aged mother is entitled not only to the $400 credit for a dependent but also to the personal exemption of $2,500 as the head of a family," and that a widower supporting under similar cir-

cumstances a dependent child under 18 years of age also is entitled to the personal exemption of $2,500 as the head of a family, plus the $400 credit for a dependent." Also, "in order to be entitled to the $400 credit" (for a dependent), "the taxpayer must furnish the dependent his or her chief support." A personal exemption of $1,000 is allowed single persons, and $2,500 (1) married persons living together and (2) heads of families.

After entering items 24 and 25, you are now ready to sharpen your pencil and figure your way through to the end, or item 39.

When this is all figured out, turn again to page 2 and fill out all schedules where necessary. Do not neglect this. It is important.

This year you have one task that was not necessary last year or in previous years. You must file with your return, whether taxable or nontaxable, a correct statement on form 1094, which is a pink sheet obtained at the same time as form 1040. This is very important as "In case of failure to file the required statement with the return the collector must, under the statute, prepare it from the return, in which event $5 must be added to and collected as a part of the tax in the same manner and at the same time as the tax."

Now have your return sworn to and send it in, together with the amount due.

Income Tax Don't's

Don't prepare your return without first studying the instructions on the form.

Don't procrastinate. Early assembling of data permits a careful consideration of all tax problems.

Don't destroy the memoranda from which your return was prepared.

Don't omit explanation when such information is essential to an intelligent audit. Attach memoranda to your return.

Income Tax in a Nutshell

Who? Single persons who had net income of $1,000 or more or gross income of $5,000 or more, and married couples who had net income of $2,500 or more or gross income of $5,000 or more must file returns.

When? The filing period begins Jan. 1 and ends March 15, 1935.

Where? Office of the Collector of Internal Revenue for the district in which the person lives or has his principal place of business.

What? Four per cent normal tax on the amount of net income in excess of the personal exemptions, credit for dependents, earned income credit, dividends of domestic corporations subject to taxation and interest on obligations of the United States and obligations of instrumentalities of the United States; surtax on surtax net income in excess of $4,000.

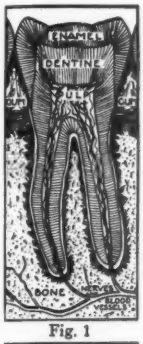


Fig. 1

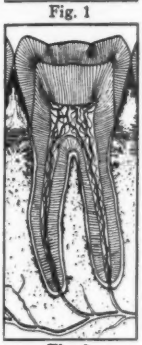


Fig. 2

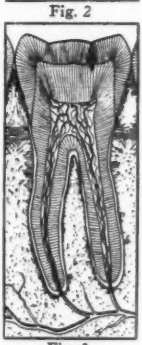


Fig. 3

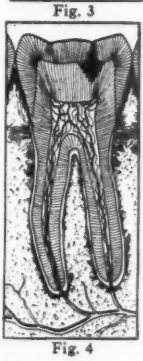


Fig. 4

THE PROGRESS OF DENTAL DECAY AS TOLD BY THE TALKING TOOTH

Developed by the Centennial Dental Congress, the Talking Tooth portrayed the progress of dental decay nearly 14,000 times to Century of Progress visitors during 1933-1934.

Through the courtesy of the Centennial Dental Congress officers, the following stereopticon lecture and slides based upon the original Talking Tooth exhibit can be secured from the Bureau of Public Relations, American Dental Association, 212 East Superior Street, Chicago, Ill.

The Story as Told by the Talking Tooth

I am the "Talking Tooth" and I wish to tell my story of thrilling adventure and tragedy. This is the story of millions of similar tragedies which occur every year and altogether they constitute a menace to the health of the nation. In most part, they may be avoided.

I am a first permanent molar. Dame Nature devoted nearly six years of painstaking labor to the building of my enamel crown (Fig. 1). The dentin was being built at the same time, but it required four more years to complete it. Inside the dentin is the pulp. This tissue is commonly called the "nerve" of the tooth, because it contains the nerves which are involved when one has pain in a tooth. Branches of the blood vessels and nerves pass into the pulp from the jaw bone. The outer surface of the root has a covering called cementum. This is connected with the bone by a mass of minute muscles, which hold the tooth in place and serve as a shock absorber in chewing. This tissue supports the gums.

Ten years of careful, conscientious effort were required to construct me that I might perform a useful service for many years in the mouth of a certain boy named Johnnie.

Soon after the day on which this boy was born, the first little bit of enamel was formed and there was continuous careful building. I was very happy over my prospects as a life helper to this boy. I lacked just a little of being absolutely perfectly formed. There was one very small defective spot, a pit in the enamel (Fig. 1). Possibly Johnnie did not have the proper foods while my crown was being formed.

More than a year ago there appeared a speck of decay in the defective spot in the enamel. It did not cause pain and the boy didn't know about it. If he had gone to the dentist for an examination, the decay would have been discovered and a small filling then might have prevented all my troubles (Fig. 2).

The decay continued to destroy more and more of the enamel and

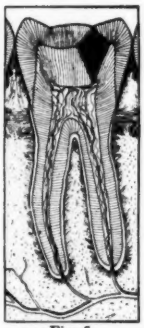


Fig. 5

Fig. 6

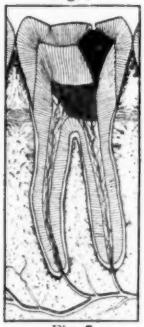


Fig. 7

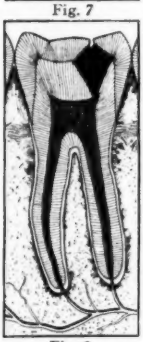


Fig. 8

then progressed into the dentin; still there was no pain. Even then, it would have been a simple matter for the dentist to have made a filling without pain (Fig. 3).

The decay has a peculiar way of spreading at the same time that it gets deeper, so that it enlarges in every direction. As it spreads in the dentin, it undermines sound enamel and then attacks the enamel from the under side (Fig. 4). A large cavity gradually develops, although the opening through the enamel may not be much larger than a pin (Fig. 5).

Oh! pardon me for screaming, but see that red spot (Fig. 6). The decay has reached the pulp—*"the nerve is exposed."* Say but that hurts. Notice all of those little green spots scattered through the pulp. They are lymph vessels, which carry infection.

The pain keeps the boy awake most of the night, but it is better in the morning, so he begs his father not to take him to the dentist because he is afraid the dentist will hurt him.

It will doubtless surprise many people to know that, as a result of modern methods of dental practice, millions of children have grown up without having had a single toothache, also without having had a permanent tooth extracted.

Things happen rapidly now. Every time Johnnie takes a drink of cold water, the sharp pain returns, then gradually subsides (Fig. 7). When he goes to bed, it aches again and keeps him awake for an hour or so. The pulp becomes more and more inflamed and the pain is occasionally more severe. But Johnnie is more careful about drinking cold water and he complains as little as possible so that his parents will not take him to the dentist (Fig. 8). Even now, this tooth could be treated and saved for a life-time of usefulness.

After a time, some of the pulp tissue dies, as shown by the large green area (Fig. 9). The inflammation continues to the end of the root and beyond. Before many days the entire pulp is dead and then the tooth is more comfortable, because the nerves which caused the pain are also dead. The immediate crisis is past and Johnnie thinks his tooth is O.K. again.

But other things happen. There is infection in the bone about the end of one root (Fig. 10). It may hurt a little occasionally or possibly not at all. After several days or possibly several weeks, the inflammation becomes more extensive and pus forms in the center. The area gradually enlarges. Finally, Johnnie is taken to the dentist, who finds the little hole in the enamel. Soon he discovers a large area of decay which extends to the pulp. He finds that the pulp has died, so he takes an X-ray picture and here is what it shows —a large abscess in the bone (Fig. 11). The dentist says "It is too bad, Johnnie, but this tooth must be extracted. Such a tooth might cause you to have a serious infection elsewhere, your appendix or some other place."

May I, the "Talking Tooth," enter a plea with my listeners? Nature spent years in building me; I expected to perform the task of assisting in the proper chewing of this boy's food for many, many years and thus do my part to keep him healthy. But now I have, instead, become a menace to his health and I must be sacrificed.

Mother Nature has laws which require that each person do

certain things in cooperation with her. If these are neglected, trouble comes. Nature is a stern mother. Johnnie's parents did not understand. If they had taken Johnnie to the dentist when he was 3 years old, and frequently afterward, the cavity in my crown would have been discovered early, my other troubles would have been prevented and I might have served for three score and ten years.

I came to A Century of Progress just to tell every father, mother and child about Johnnie and myself, with the hope that millions of toothaches might be prevented in the future.

But I face the inevitable; I bid you good-bye (Fig. 12).

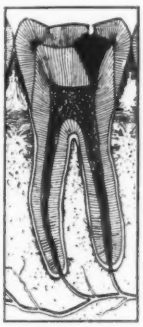


Fig. 9

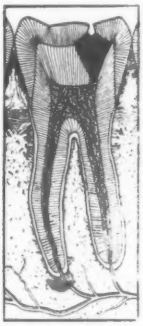


Fig. 10

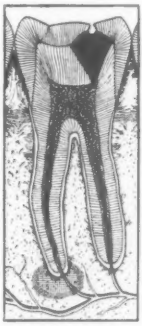


Fig. 11

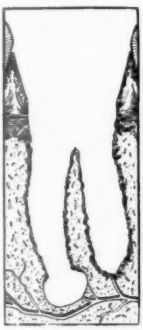


Fig. 12

MASSACHUSETTS DENTAL HYGIENE CERTIFICATE REPORT

The Massachusetts Dental Hygiene Program, under the direction of Mrs. Eleanor G. McCarthy, D.H., has enjoyed a steady, healthy growth during the past seven years, as is indicated by the following table of statistics:

	1927-1928	1928-1929	1929-1930	1930-1931	1931-1932	1932-1933	1933-1934
No. of cities & towns reporting	78	126	178	226	243	299	261
Elementary school membership for Mass. (grades 1-8)	535,551	533,545	529,764	530,818	525,853	542,108	518,227
Dental Certificates awarded by:							
School dentist at examination	Not reported separately	Not reported	Not reported	14,839	25,431	28,679	29,117
Clinic dentist		23,052	45,989	51,624	64,106	68,901	78,898
Family dentist		27,296	44,744	64,052	38,260	48,474	41,688
Total no. children receiving certificates	25,949	50,348	90,763	130,515	127,797	146,054	149,703
Percentage of elementary school population receiving certificates	5	9	17	25	24	27	29

CURRENT LITERATURE

The Treatment of Agranulocytosis with Adenine Sulphate (Paul Reznikoff, J. Clin. Investigation, January, 1933): In eleven of fifteen uncomplicated cases of agranulocytosis, treatment with adenine sulphate was followed by recovery. In severely complicated cases, this therapy was not effective. The dosage used for adults was 1 gm. of adenine sulphate boiled in from 35 to 40 c.c. of physiologic solution of sodium chloride, sufficiently warm to prevent precipitation, administered intravenously three times a day for at least three days. As much as 10.4 gm. was given to a patient within seven days, with no ill effects.—Abstr., *Am. J. Dis. Child.*, December, 1934.

Vitamin A Deficiency in Infants (Kenneth D. Blackfan and S. Burt Wolbach, J. Pediatrics, November, 1933): The authors report on thirteen infants in whom lesions characteristic of vitamin A deficiency were found at necropsy. A brief summary of the present knowledge referable to vitamin A deficiency is presented. In six of the patients a clinical diagnosis was made during life because of keratomalacia. In the remaining seven patients the diagnosis was made by finding stratified keratinizing epithelium at necropsy. The following points are of value in detecting early signs of vitamin A deficiency: (1) dietary history; (2) a history of morbid processes interfering with the absorption of fat; (3) night blindness and xerosis of the cornea, and (4) demonstration of keratinized epithelial cells in scrapings from the cornea, nose, mouth and secretions of the trachea, kidneys and vagina.—Abstr., *Am. J. Dis. Child.*, December, 1934.

Evipal Sodium—A Short Intravenous Anesthesia (By E. M. Livingston, S. Emy and H. Lieber, Am. J. Surg., December, 1934): The authors note that the anesthesia is little used in America although employed extensively in Germany and Great Britain. More than 50,000 administrations are reported in the foreign literature. The material for this paper is based on 280 cases of evipal anesthesia at Bellevue Hospital, New York City. A 10 per cent solution is used for intravenous injection. Within one minute, the patient falls asleep, without asphyxia, discomfort, excitement or struggle. The respirations become deeper and slower and muscular relaxation sets in early. The color remains unaltered. The pulse stays full and regular, the blood pressure falls from 5 to 20 mm. with the onset of sleep and promptly returns to normal. Awakening depends on the dosage, which is from 7 to 10 c.c. according to the patient's weight. In exceptional cases, respiratory failure from overdosage occurs. Backward falling of the tongue may cause embarrassment. Excitement was observed in 1 per cent of cases. A study chart of the 280 cases includes nine extractions and five alveolectomies. Evipal should not be employed in the presence of liver trouble or in the face of mechanical interference with the air passages and should be used with caution in severe sepsis or masked depression of the respiratory center.

The Common Cold (P. H. Long, Michigan M. Soc. J., December, 1934): Long, in discussing the common cold, states that there is no specific remedy for the treatment of colds. His observations have led him to believe that the only rational treatment is to put the patient to bed at the onset of the infection and make him remain there for two or three days. Diet has little effect in the treatment of colds, but it is wise to force fluids moderately. A mild laxative is of value if constipation exists, and it is a good plan to treat the distressing features of the disease symptomatically. If such a regimen is followed, many infections will be aborted, many complications

averted and many contact infections avoided. The multiplicity of the measures designed to prevent colds attests their lack of reliability. At present, hardening exercises, vitamin feeding, ultraviolet radiation and bacterial vaccines occupy the first rank of popularity as prophylactic measures designed to protect one against colds. When, however, the relation of the hardness of persons is correlated with their resistance to infections of the upper respiratory tract, it is found that the degree of hardness or softness of an individual has nothing to do with susceptibility to colds (Gafafer). Carefully controlled observations on the use of vitamins A and D are disappointing, and in a recent report Clausen suggested that too much vitamin A may predispose a child to respiratory tract infection. The clinical studies of Colebrook and of Doull and his associates have demonstrated quite definitely that ultraviolet radiation does not reduce the incidence of infections of the upper respiratory tract nor does it decrease the duration or severity of such diseases. The failure of vitamin therapy as a prophylactic measure in colds can be understood if one bears in mind that in general the national dietary is not lacking in these essential substances. Early reports seemed to show that the incidence, severity and duration of infections of the upper respiratory tract were materially lessened in subjects inoculated with bacterial vaccines. During the last fifteen years, however, carefully controlled studies have demonstrated that there is but little basis for the claims of the enthusiastic exponents of bacterial vaccines. The failure of bacterial vaccines in the prophylaxis of colds can be explained on the basis that the ordinary bacteria of the rhinopharynx have nothing to do with the initiation of the primary infection of the upper respiratory tract known as the common cold. That these vaccines have little effect in reducing the severity or duration of the infection can be understood if it is remembered that in man there is little evidence of pathogenic activity by the so-called secondary invaders in uncomplicated common colds. At present the only prophylaxis against colds is the avoidance of contact with infected persons. There is no other method.—*J.A.M.A.*, Jan. 19, 1935.

Chronic Glossitis: I have a patient who has a sore tongue; also the surrounding mucous membrane of the mouth is sore. It is red. The tongue is clear of a membrane and is not coated. The patient had a very severe grade of secondary anemia, which is now improving under treatment. Will you kindly state the possible etiology and treatment for this condition?

The description of a chronic red tongue and redness of the adjacent oral mucous membrane, with great soreness, is suggestive of a chronic disease of the tongue known as Moeller's glossitis. The best article on this is by F. G. Harris (*J. Cutan. Dis.*, 33:742, 1915). The etiology in most cases is obscure. Most of Moeller's cases were in persons having intestinal worms; but Harris's cases and those reported by others did not present such infestation. Engmann and Weiss (*Arch. Dermat. & Syph.*, 1:119 [Feb.] 1920) reported a case in which endamebas were found in tooth abscesses. On extraction of the teeth and treatment with emetine, the patient (Zinnser: *Handbuch für Dermatologie und Geschlechtskrankheiten*, 14: 101) states that all cases of Moeller's glossitis are due to pernicious anemia. While his statement finds little support in the case histories of Moeller's glossitis, his advice, that in all such cases the blood should be carefully studied and watched for a long time, is certainly good. The patient's own experience as to diet may be safely followed, avoiding foods that cause pain, except in severe cases, in which all foods cause pain. Attempts to anesthetize the tongue before meals may then be made, using phenol in glycerin 5 per cent or stronger or orthoform powder on the tender areas, rinsed off before eating. Sharp tooth corners should be smoothed down. All foods should be soft. Roentgen treatments are said to relieve the pain temporarily. They should be kept below the erythema dose. Use of ultraviolet radiation is also credited with temporary relief of pain. Hutter, Middleton and Steenbock

found that rats (Vitamin B Deficiency and the Atrophic Tongue, *J.A.M.A.*, Oct. 21, 1933, p. 1305), after about thirty-nine days on a diet deficient in vitamin B_2, lost the normally very sharp papillae of the tongue, a smooth dorsum much like that of the atrophic tongue of man remaining. When vitamin B_2 was supplied, the papillae reappeared and the tongue appeared normal. They therefore suspected that vitamin B_2 deficiency might have some relation to the atrophic tongue. Their effort to cure such tongues by diets rich in vitamin B_2, however, were not successful enough to be convincing. Tomato juice or yeast by mouth and liver extract intramuscularly could be tried in the case under discussion, if this has not already been done.—*J.A.M.A.*, Jan. 26, 1935.

Malpractice: Fragments of Extracted Tooth Lodged in Lung: The plaintiff sued the defendant-dentist for malpractice claiming that while extracting several of her teeth under a general anesthetic the dentist permitted fragments of one tooth to become lodged in her right lung, and that he failed to inform her of that fact. Judgment for $25,000 was given for the plaintiff, and the defendant-dentist appealed to the Supreme Court of Oregon. The trial court did not err, said the Supreme Court, in permitting an expert witness to testify that the treatment and care administered by the defendant, as outlined in a hypothetical question, was not in conformity with that degree of care, skill, diligence and knowledge ordinarily possessed and exercised by the average dentist in good standing in the same or similar localities. This testimony did not trespass on the province of the jury. The trial court erred, further contended the defendant, in instructing the jury that he was required to exercise the degree of care ordinarily exercised by a specialist, since there was no allegation in the complaint that he was employed by the plaintiff as a specialist. Regardless of the allegations of the complaint, said the Supreme Court, the defendant as a witness in his own behalf, without objection, placed himself in the category of a specialist. He testified that his main work was extracting teeth and he classified himself as an extraction specialist. If this was true, then the plaintiff was entitled to the defendant's skill as a specialist. Two allegations in the complaint, contended the defendant, which charged that he "hurriedly, carelessly, negligently and wantonly failed and neglected" to exercise care to see that no tooth or fragment thereof escaped into the trachea or so failed and neglected to discover whether any extracted tooth, or fragment thereof, had not been removed from the plaintiff's mouth, should on his motion have been withdrawn from the consideration of the jury because there was no competent evidence to establish the negligence alleged. The Supreme Court held, however, that it was proper to allow the jury to consider the allegations. During the operation the plaintiff was unconscious. No one else was present except the defendant and his assistant. The plaintiff could not testify as to any of the alleged acts of negligence and obviously the others present would not. The fact remains, said the court, that fragments of a tooth were not removed from the plaintiff's mouth and that they escaped into the trachea. The jury could, in view of the circumstances and of the testimony of expert witnesses, reasonably infer that the defendant's negligence as charged in the allegations was responsible therefor. The Supreme Court could find no error in the record and consequently affirmed the judgment for the plaintiff.—Schamoni v. Semler (Ore.), 31 P. (2nd) 776.—*J.A.M.A.*, Jan. 12, 1935.

"Push-Back Operation" in Cleft Palate Surgery (George M. Dorrance, Ann. Surg., 101:212 [Jan.] 1935): The author's operation is for use in cases in which the velopharyngeal closure by the methods ordinarily employed has been or would be unsuccessful. Velopharyngeal closure is accomplished by the "palatopharyngeal sphincter," a definite sphincter muscle which produces circular contraction of the nasopharynx. If the palate is short, normal function is not restored by the ordinary operation which restores the anterior con-

tinuity of the superior constricter muscle of the pharynx. In the "push-back operation," two or more distinct operations are performed to lengthen the palate and allow it to establish its collateral circulation. Three months are allowed between the first and second stages. In the closing operation, an aluminum-bronze intermuscular suture is used to relieve tension. The "push-back operation" is recommended in cases of congenital shortening of the palate, cleft velum and cleft palate, which extends as far forward as the junction of the middle with the anterior third of the hard palate. The operation should not be performed in a child under 5 years of age.

HAMILTON ROBINSON.

Dental Caries as an Indication of a Dietary Fault (N. P. Larsen, M. P. Jones and G. P. Pritchard, Am. J. Dis. Child., 48:1228 [Dec.] 1934): The authors' observations on Hawaiian and Oriental children, confirmed by observations from the Island of Tristan de Cunha, led them to the following conclusions: (1) heredity is not the important factor in dental decay, (2) soft foods with great stickiness do not cause dental decay, (3) sufficient calcium alone does not correct the condition, (4) vitamin D alone does not correct the condition and (5) dental decay is due to a metabolic or dietary fault and not to an oral condition. Three different diets were fed to three groups of children for a period of from twelve to fifteen months, and it was observed that excessive dental decay is an indication of a gross dietary fault and that use of a diet with carbohydrates of acid residue replaced by alkaline starches and a small amount of vegetable helps to lower the rate of infant mortality and results in a correction of dental defects.

M. K. HINE.

Taste Fibers and the Fifth Nerve (R. Wirtanen and J. M. D. Olmstead, J. Comp. Neur., 60:1, 1934): Many authors of textbooks assert that taste fibers from the anterior two thirds of the tongue must reach the brain by way of the fifth nerve, assuming that these fibers pass from the lingual and chorda tympani nerves to the gasserian ganglion by way of the great superficial petrosal and vidian nerves. Division of the vidian nerve in the cat and uncomplicated removal of the gasserian ganglion in the dog do not tend to disappearance of the taste buds in the anterior two thirds of the tongue. It is concluded that taste buds do not pass to the brain by either of these two structures. It is generally accepted by neurologists that taste buds on the anterior two thirds of the tongue are innervated by fibers of the chorda tympani and these fibers originate from cells in the geniculate ganglion, and they enter the brain by the nervus intermedius (Wrisbergii).

ALTON D. BRASHEAR.

Leukoplakia Buccalis and Cancer (S. H. Sturgis and C. S. Lund, New Eng. J. Med., 212:7, 1935): Of 248 selected cases of leukoplakia and keratitis of the mouth and lips showing no malignancy on entry and observed for a period of five years or more, twenty-five developed buccal cancer, twelve of those patients dying of cancer. This compares with an expectancy of one death from buccal cancer by comparison with the normal death rate for the state (Mass.) over a similar period. Observations on these twenty-five cases that developed cancer while under scrutiny affords an opportunity for comparison of cases developing cancer (twenty-five) and cases not developing malignancy (223). So-called etiologic factors such as sex, age, syphilis, use of tobacco and dental hygiene appear of no value in predicting malignancy. Lesions within the mouth are less amenable to treatment and duration of the disease seems irrevalant, but the extent of the premalignant lesion seems of some importance. The authors believe that it is not so much syphilis, use of tobacco or faulty dental hygiene that make a case hopeless, but rather lay stress on the time the lesion reaches the physician and his immediate treatment.

HAMILTON ROBINSON.

Sequence of Epiphyseal Union, Third Molar Eruption and Suture Closure in Eskimos and American Indians (T. D. Steward, Am. J. Phys. Anthrop., 19:433, 1934): The variability of tooth eruption

in contrast to epiphyseal union is remarkable. Either the teeth are much more sensitive to environment than the epiphysis or they are influenced by other factors. A marked group difference is demonstrated for third molar eruption relative to epiphyseal union. The Eskimo exhibits earlier eruption and the same is true of the Florida Indian. On the other hand, eruption occurs latest among the Pueblo Indians. Irregularity characterizes this process much more than epiphyseal union. It seems clear that early eruption of the third molar correlates with sound teeth in the Eskimo; whereas, the opposite is true for the Pueblo. The Florida Indian ranks with the Eskimo in tooth quality. It is difficult to locate data on the relationship between tooth eruption and epiphyseal union in the white race, but presumably the same conditions that accelerate or retard tooth eruption also effect epiphyseal union, although probably to a different degree. Adequate diet and freedom from disease accelerate epiphyseal union and other physiologic processes, including, undoubtedly, tooth eruption.

ALTON D. BRASHEAR.

Study of the Teeth of a Group of School Children Previously Examined for Rickets (M. Elliot, S. P. Souther, B. G. Anderson and S. S. Arnim, Am. J. Dis. Child., 48:713, 1934): A survey of the literature relevant to the effect of rickets in the production of hypoplasia and caries of teeth is presented. A study was made of the teeth of 480 children who had been given antirachitic treatment in infancy and 1,000 untreated children, with the follow-up examination on 451 of these. Of 128 children known to have had rickets in early life, 34 per cent showed dental hypoplasia; while of 215 who showed minimal signs of rickets in early life, 4 per cent had hypoplastic teeth. Sixty-three per cent of the children in the first group showed dental caries; whereas, this occurred in only 43 per cent of the second group. The occurrence of hypoplasia and caries in various teeth was estimated from charts to be approximately 7 per cent hypoplastic and 35 per cent carious for the upper first molars and 7 per cent hypoplastic to 42 per cent carious in the lower; and 15 per cent hypoplastic to 3 per cent carious in the upper first incisors and 10 per cent hypoplastic to 2 per cent carious in the lower. Four per cent of 281 hypoplastic incisors were carious and 1 per cent of 2,118 normal incisors were carious; 50 per cent of 101 hypoplastic molars were carious and 36 per cent of 1,502 normal molars were carious. From the charts, it appears that the percentage of negro children showing hypoplasia was greater, while the percentage showing caries was less than in white children. It appeared that the hypoplasia of the teeth could be prevented by early antirachitic treatment and that the incidence of hypoplasia was less when larger doses of cod liver oil were used.

BASIL G. BIBBY.

Utilization of Calcium Salts by Children (G. Stearns and P. C. Jeans, Proc. Soc. Exp. Biol. Med., 32:428, 1934): Children 4 to 12 years of age were given calcium salts in amounts such that the calcium content was equivalent to that in a pint or quart of milk. The protein intake was kept approximately constant. The salts used were calcium lactate, carbonate and gluconate and the diphosphates and triphosphates. In general, calcium and phosphorus retention were approximately equal to those from equivalent quantities of milk. When intake levels of calcium and phosphorus were approximately equal, the retention of both was good, but the greater the difference between the intake levels of calcium and phosphorus, the less satisfactory were the relative retentions. Therefore, calcium phosphates seem more desirable sources of calcium for the growing child.

HAROLD C. HODGE.

Ewing's Tumor (Endothelial Myeloma) of the Mandible: or Diffuse Myelosarcoma (G. T. Hankey, Proc. Roy. Soc. Med., 27:1604 [Nov.] 1934): A girl, aged 16, eleven weeks before appearing had the mandibular right first molar removed for tenderness and pain of four days' duration and swelling of one day's duration. The extraction had relieved the pain, but ten-

derness returned. Now the mandible showed a soft, pink granular mass, of the same color as the gum and extending from the first molar socket to the second incisor. The included bicuspids were loose. The roentgen rays revealed only rarefaction of the alveolar border and periodontitis of the bicuspids. The biopsy report was "severe chronic inflammation of the gum." Before her return, severe abdominal symptoms developed and an appendectomy was performed. The mandibular tumor meanwhile grew rapidly; and one month after her first visit, as much of the mass as was possible was removed. Microscopic examination was reported as "polygonal, spheroidal, undifferentiated, epidermoid-celled, medullar carcinoma of the gum." A hard swelling beneath the mandible grew rapidly and radium needles were implanted, reduction resulting. Six weeks later, a hard swelling appeared on the left tibia, and it was learned that, three weeks prior to the first dental symptoms, the patient had sustained a severe blow on the shin at the spot where the present swelling developed. After some time, this area of swelling was excised and reported as "Ewing's tumor." A comparison of sections from the mandible and from the tibia showed identical structure. The tumor spread throughout the skeleton and the patient died eleven months after the onset of the tumor. This tumor is said to arise from some type of endothelial cell of the bone marrow. It occurs in childhood with slow onset of pain and intermittent attacks of fever. The duration is from three months to three years, usually with fatal termination. It disseminates by invasion of regional lymph nodes and by cell emboli or by multiple primary growths.

HAMILTON ROBINSON.

Observations on the Fifth and Seventh Cranial Nerves (E. A. Carmicheal and H. H. Woollard, Brain, 56:109, 1933): The fifth nerve is the most general cutaneous nerve of the head region; the opthalmic, formerly a separate nerve, is the most rostral of the body nerves. In ten cases of injection of the gasserian ganglion with alcohol, there was complete destruction of the ganglion as judged by the extent and completeness of anesthesia. The longest duration of anesthesia was ten years. Evidence is produced to strengthen the idea that all reflexes dependent on the ophthalmic division require a stimulus which in normal persons is felt as pain. The problem as to why a number of patients, after destruction of the gasserian ganglion, lose taste on the anterior two thirds of the tongue is discussed, but no satisfactory explanation is presented. Evidence is presented that deep pressure pain depends on the integrity of the fifth nerve only. The conclusion is drawn that the afferent fibers of the seventh nerve, other than taste, and of the third nerve, subserve a proprioceptive function and do not convey pain impulses. Blocking of the seventh nerve has no effect on the paresthesia following destruction of the gasserian ganglion. Throughout the investigations, no evidence was obtained that the impulses associated with pain in the face and orbit follow any pathway other than that of the fifth nerve.

ALTON D. BRASHEAR.

The Saliva (Frans Duyvenz, Proc. Roy. Soc. Med., 27:1583 [Oct.] 1934): Although there is no general agreement, it is assumed that (*a*) a stream of serum passes through the tooth to the pulp, or (*b*) a stream of saliva passes from the pulp through the tooth to the saliva. The stream may thicken in the outer layers of the enamel and permeability be interrupted. In making tests of the saliva, only "normal resting saliva" may be used, as any stimulation, even psychic, will alter its properties. Normally, from 1,000 to 2,000 c.c. are secreted daily. During pregnancy, hypophyseal hormones overrun the body and some of this excess is secreted through the salivary glands; which leaves the saliva a reliable fluid for pregnancy tests. The effort of the body to rid itself of the excess hormone through the kidneys and salivary glands is possibly the cause of excess salivation in pregnant women and in persons of strong physique. The hydrogen-ion concentration was determined by the Hellige and by the Wulff apparatus. A study of the calcium content of saliva revealed that

an alkaline saliva usually has a low phosphorus and a high calcium content, with the reverse true in acid saliva. Calcium was found associated with albumin and, in cases of infection, such as pyorrhea, serum calcium may come out of the blood vessels of increased permeability and accumulate in the pockets. The calculus then would be from the blood and not from saliva. From 0.05 to 0.17 mg. of calcium sulphocyanate was found in the daily saliva, probably converted from nitrates.

HAMILTON ROBINSON.

Present Status of Infection of the Upper Respiratory Tract in Its Relation to Focal Infection (W. V. Mullin, New Eng. J. Med., 212:50 [Jan. 10] 1935): Infection of an organ is not necessarily the result of the presence of a focus of infection elsewhere, but infection may attack various tissues with lowered resistance at the same time. The importance of various foci are as follows: tonsils, prostate, cervix, gastrointestinal tract and sinuses. The teeth are true foci potentially, for their structure almost compels absorption of the locked in infection. The tonsils, on the other hand, may only be portals of entry, the infection going on elsewhere in the body while they clear up. Removal of foci is of undoubted value, but we should not jump at conclusions. Overzealous enthusiasm may result in the removal of questionably infected, or even sound, teeth or extensive sinus operation, because the true diagnosis of fifth nerve neuralgia was not made. Before surgical intervention in suspected cases of focal infection, the case should be carefully studied and everything else that might help should be tried.

HAMILTON ROBINSON.

Treatment of Malignant Disease in the Upper Jaw (W. D. Harmer, Lancet, 1, No. 3 [Jan. 19] 1935): Three main groups of growth involving the antrum are considered: 1. Carcinoma, seventy cases (64 per cent). 2. Sarcoma, twenty-nine cases (26 per cent). 3. Endothelioma, eleven cases (10 per cent). The importance of early diagnosis is emphasized. Partial operations on cancer the author considers as amounting to malpractice. Before biopsy is made, a short course, about one third dose, of deep roentgen-ray therapy is given. Treatment consists of a combination of surgery, diathermy and roentgen-ray irradiation. With this combined treatment, it is found that "cancer of the upper jaw is easier to cure than in any part of the upper air passages with the exception of the larynx."

M. K. HINE.

Adamantinoma of the Upper Jaw (L. S. Ghosh, Am. J. Path., 10:733, 1934): There is some doubt as to whether there exists any basis for differentiating "dental cysts" and "dentigerous cysts" from adamantinoma. Adamantinoma might include all jaw growths with a persistent epithelial factor irrespective of contents. Growths of purely malpighian type epithelium may be taken as an exception; for, while the basal cells of embryonic dental structure may undergo evolution to a stratified or columnar type, there is no evidence that cylindrical ameloblasts may be transformed into malpighian cells. The term "paradental acanthoma" may be used for those tumors of purely malpighian type arising in the paradental débris. Adamantinoma frequently recurs, probably as a result of incomplete removal and the recurrent growths may show a different histologic structure. The author's case is that of an 18-year-old East Indian youth with a hard, painless swelling of the left maxilla which, on removal, was found to be partly solid and partly cystic, and contained a third molar. Microscopic examination showed adamantinomatous structure. Dental sepsis may be a factor in the etiology of these tumors and the better drainage of the maxilla may account for their rarity at that site.

HAMILTON ROBINSON.

FOREIGN LITERATURE

Results Obtained from a Study of the Physiologic and Histologic Research on the Question of the Innervation of the Human Teeth (J. Munch, Deutsche Zahn.-Mund- u. Kieferheilk., August, 1934): The nerve trunks of the pulp are in close connection with the blood vessels. The large and small blood vessels are almost completely im-

bedded in the nerve trunks. There nerve trunks and vessels form the main part of the pulp and have undoubtedly a vasoconstrictor action. This probably does not take in the capillary system, which is not related to the other blood vessels. A small portion of the pulp nerves continues into the odontoblastic layer, fibrillate into a comparatively thick trunk on all the sides or form an end knot giving off fibrils on all sides which cover the whole pulp. This is the Raschkowsch plexus. Many simple fibrils end at the fibrillation point in the form of a knotty thickening, or in the form of end loops. From Raschkowsch's plexus and also from the end knots, individual fibrils branch off and run between the odontoblasts into the dentin. The nerve supply of the dentin comes from Raschkowsch's plexus, the nerves running in the dentinal tubules and in the intercementing substance.

OSCAR KARPF.

Clinical Observations on Gingivitis Gravidarum (Rudolph Ernst Stroh, Zahnarztl. Rund., 43:1749-1754, 1934): Gingivitis gravidarum is an inflammatory reaction of the gingivae occurring during pregnancy and disappearing spontaneously after delivery. All expectant mothers with a history of exudative diathesis suffer from gingivitis gravidarum. When this condition does not undergo a more severe course, a chronic inflammation does not develop. The occurrence of gingivitis gravidarum appears usually between the fourth and seventh month of pregnancy and disappears from ten to twenty-one days postpartum. Various mouth washes may be used therapeutically.

OSCAR KARPF.

Clinical Tests of the Antirachitic Activity of Calciferol (J. C. Spence, Lancet, Oct. 21, 1933): Pure vitamin D in crystalline form was isolated simultaneously by workers in Germany, who called it "vitamin D_2." Twelve actively rachitic children were treated with daily doses of the pure vitamin D for eleven weeks or more. The therapeutic effects were estimated by serial roentgenograms, which were compared with a standard scale of the optional rate of cure. It was found that the pure vitamin D had an active curative effect on the rickets and that it produced healing at an optimal rate, acting as quickly and as effectively as the usual therapeutic doses of cod liver oil or viosterol.—Abstr., *Am. J. Dis. Child.*, December, 1934.

CURRENT LITERATURE

Effects of Vitamin C Deficiency on Tooth Structure in Guinea Pigs (By E. Wilfred Fish and L. J. Harris, Brit. D. J., Jan. 1, 1935): The authors give a thorough and analytic review of the work of their predecessors, describing their methods, and results in detail and the effects of scurvy on all the dental tissues. They conclude that deficiency of vitamin C appears to affect the vitality of all cells concerned with the laying down of hard tissues. Ameloblasts, odontoblasts and cementoblasts all suffer. In severe cases, the entire pulp undergoes degenerative changes.

Content of Saliva in So-Called Blood Group Ferment (O. Sievers, Klin. Wchnschr., Nov. 17, 1934): Sievers, after calling attention to studies by Witebsky and particularly to those by Satoh reported in *Klinische Wochenschrift* (June 2, 1934; abstr., *J.A.M.A.*, July 28, 1934), describes his own studies on this subject, which have direct connection with those of Satoh in that they were aimed at determining whether the amount of blood group ferment in the saliva undergoes in the course of the day certain fluctuations dependent on the meals, and whether these fluctuations are independent of the other constituents of saliva. The author was able to corroborate Satoh's statements about the decrease or the disappearance of the blood group ferment following irrigation of the oral cavity. A comparative constancy of the content of the saliva in A substance could likewise be corroborated. Further experiments were made to determine whether the disappearance of the blood group ferment leaves the diastase action of the saliva unimpaired. It was found that, whereas the blood group substance and diastase showed no decrease

after breakfast but rather an increase, the blood group ferment decreased greatly. This indicates that there is no connection between the action of the diastase and the blood group ferment. Examination of the saliva at various times during the day disclosed that the blood group ferment is either lacking or greatly decreased after meals, but that it again increases to its maximum within four or five hours. The strongest ferment action could be demonstrated in the saliva taken while the person was still fasting. The author observed further that all persons whose saliva was examined had blood group ferment, although the action was not demonstrable in every experiment. Moreover, the amount of ferment may vary in the same person even if the specimens have been withdrawn under the same conditions. In other experiments, it was observed that specimens of saliva that influenced heated A saliva always destroyed the A substance in Witte's peptone, but that, on the other hand, the blood group ferment action was occasionally directed only against the A substance in Witte's peptone without exerting a noticeable influence on that of the saliva. This proves that Witte's peptone is a more susceptible A substrate for the blood group ferment than is the saliva.—*J.A.M.A.*, Jan. 26, 1935.

Anomalies of Teeth in Congenital Syphilis (J. Guszman, Arch. f. Derm. u. Syph., Nov. 10, 1934): Guszman describes his observations on the teeth of 116 adults with congenital syphilis. He points out that there are a number of anomalies of the teeth the presence of which is considered suggestive of or characteristic for congenital syphilis. He mentions the following: (1) late second dentition, (2) microdontism, (3) absence of certain groups of teeth, particularly of the upper lateral incisors, (4) dystrophic crowns, that is, hypoplasia of the dental enamel with its numerous variations (apical and surface erosions, small circular or bowllike erosions, "stair" teeth or the so-called clove teeth), (5) atrophy of the chewing surfaces, particularly of the first molars, (6) abnormal position of the teeth, (7) "amorphic" teeth (so-called fish teeth), and (8) Hutchinson's teeth. The author considers Hutchinson's teeth the most important of the dental anomalies of congenital syphilis, but admits that they are not frequent. He observed them in 12 per cent of his patients with congenital syphilis. In spite of opinions to the contrary, he asserts that really typical Hutchinson's teeth are found only in persons with congenital syphilis. Further, he gives illustrations of fifteen different dental anomalies that he observed in his material: microdontism, absence of the two upper lateral incisors, large gaps between the teeth, hyperplasia of the upper median incisors, hypoplasia of the proximal portion of the crown of the upper median incisors, hypoplasia of the incisors and the canine teeth, crooked position of the teeth, misplacement of a tooth (so-called gum tooth), fish teeth, pointed teeth, typical Hutchinson's teeth, pivot tooth, teeth with half moon shaped erosions, wedge-shaped cutouts on the upper median incisors and long amorphic teeth. The author admits that with the exception of Hutchinson's teeth, the anomalies are not a sufficient basis for a diagnosis of congenital syphilis, but they should be an inducement for further search for other symptoms, and in this manner they may lead to the discovery of the otherwise entirely latent congenital syphilis.—*J.A.M.A.*, Jan. 19, 1935.

Infected Teeth and the Care of Teeth in Childhood (Hans Pichler, Wien. klin. Wchnschr., June 30, 1933): Pichler writes that the care and treatment of teeth during childhood is of great prophylactic significance, and that more can be done to remedy the diseases and defects of teeth during childhood than during later life. Because of the possibility of treating large shifts, dental care in the schools is the most important phase of dental and oral hygiene, and much can be accomplished by such treatment. However, treatment may be too late, since irreparable injuries frequently occur during preschool age. Since it is impossible to enforce seemingly obligatory care of children during preschool age at present, the pediatrician can contribute considerably to prophylaxis. Wherever

possible, even prior to the appearance of manifest infections of the milk teeth, he should insist on regular dental examination and treatment.—Abstr., *Am. J. Dis. Child.*, January, 1935.

Urea in the Saliva of the Child (G. Scarpulla, Riv. di. clin. pediat., July, 1933): The concentration of urea in the saliva is parallel to that in the blood and is usually slightly less. There is no constant relation between the urea of the saliva and the urea of the urine. In most diseases of children, the percentage of urea in the saliva is the same as that in the saliva of the normal child. In tuberculosis and a few other conditions a small rise is noted.

PERCENTAGE OF UREA IN VARIOUS CONDITIONS

	Blood Per Cent	Saliva Per Cent
Tuberculosis	0.33 to 0.48	0.30 to 0.38
Acute infections	0.29 to 0.42	0.29 to 0.37
Bronchiectasis	0.44 to 0.56	0.30 to 0.50
Tubular nephritis	0.36 to 0.40	0.32 to 0.40
Normal children	0.20 to 0.36	0.24 to 0.38

In acute glomerular nephritis with a marked increase of the urea in the blood, the salivary urea is more or less increased, but it does not remain strictly parallel with the amount of urea in the blood, and in certain instances it has been definitely less. —Abstr., *Am. J. Dis. Child.*, January, 1935.

NEWS

CALIFORNIA

Sixty-Three Are Candidates for Licenses: At the December meeting of the Board of Dental Examiners, held in San Francisco, sixty-three dentists were candidates for license to practice dentistry in California. Thirty-six were from outside this state.

DELAWARE

Bills Introduced: Bill H.10 proposes that the property of any corporation organized for the purpose of free medical or dental aid or education shall be exempt from state, county and municipal taxes to the extent that such property is actually so used.

DISTRICT OF COLUMBIA

District of Columbia to Be Host to Five States: The District of Columbia will be host to the state societies of Maryland, Delaware, North Carolina, West Virginia, and Virginia, March 18, 19, 20. Sterling V. Mead and the Hon. Nathan Cayton, judge of the municipal court of the District of Columbia will speak, the latter on medical-dental jurisprudence.

ILLINOIS

Animal Experimentation Commended: Frederick Grant Banting, professor of medical research, University of Toronto Faculty of Medicine, approved the ordinance which permits unclaimed animals at the city pound to be used for experimentation, in a recent letter to the Illinois Society for the Protection of Medical Research. He stated that his research resulting in the discovery of insulin would have been impossible had he not been able to use dogs. The use of unclaimed dogs from the city pound for medical research was approved in a resolution adopted by the Chicago Heart Association at its annual meeting, January 8. The association declared itself opposed to the pending Nelson amendment, which would prohibit this use, and favored the continuance of the Arvey ordinance. Anton J. Carlson, professor of physiology, University of Chicago, was the principal speaker at the meeting.

INDIANA

I. U. Junior Association: Announcement has been made of the organization of a junior branch of the American Dental Association among the students of the Indiana University school of dentistry, with a charter membership of forty-six. The organization meeting was held at the school in December. John E. Buhler was elected president; Robert L. Pelden and James

Bunnel, vice presidents; Otis Scott, secretary, and William Hammersly, publicity director. The Association is sponsored by the American Dental Association. Its faculty advisers are Dean Henshaw and Gerald D. Timmons.

KANSAS

Bills Introduced: Bills H. 55 and H. 56 propose to authorize the licensing of dental hygienists by the board of dental examiners. Such licentiates are to be permitted to remove calcic deposits, accretions and stains from the surfaces of the teeth, but are not to perform any other operation on the teeth or tissues of the mouth. A dental hygienist is to be permitted to operate only under the general direction or supervision of a licensed dentist, in his office or in any public school or other institution.

LOUISIANA

25th Anniversary Celebration: January 9, the Fourth District Dental Society celebrated its twenty-fifth anniversary with a meeting, election of officers and a banquet. Walter Colquitt of Shreveport was elected president and Julian S. Bernhard, secretary. Several charter members were present. G. A. Harper, the first president, addressed the meeting. The occasion also marked the fiftieth anniversary of Dr. Harper in dental practice.

MICHIGAN

Home Coming Day: The Committee on Postgraduate Education in the health sciences of the University of Michigan arranged for a home coming day for the dental profession of the state, which was held on January 25 at the school of dentistry. Lectures and clinics were given by the faculty of the school of dentistry throughout the day.

Michigan Society for the Promotion of Dentistry for Children: At the December meeting of the Michigan Society for the Promotion of Dentistry for Children held in Detroit, the speaker was Arthur C. Curtis of the Department of Internal Medicine, College of Medicine, University of Michigan, whose subject was "The Manifestations of Disease in the Head, Mouth, and Hands."

Mr. Nesbit Dead: Many of the older practitioners of dentistry will be interested in the announcement of the death of Charles A. Nesbit which occurred January 12, from a paralytic stroke. Mr. Nesbit was in Oceanside at the time. The deceased has, since 1875, been a refiner of gold and silver and manufacturer of dental materials. He was buried in the Soldier's Cemetery at Sawtelle, Calif.

MISSOURI

Kansas City Western Dental College Presented with Cogswell Models: The Kansas City Western Dental College has become owner of the Cogswell models, famous throughout the United States, illustrating the various steps of oral surgical operations. Through the persuasion of W. R. McCrassin, M.D., of Colorado Springs, a prominent citizen of Kansas City, Mr. T. J. Pendergast, who at the time was ill in Colorado Springs, became interested in the models in behalf of his home city and the Kansas City Western Dental College. Forthwith, he sought an interview with Dr. Cogswell and on his own incentive raised $25,000 for the purchase. The *Kansas City Star* states that the negotiations and gift were a surprise to the school. Dean R. J. Rinehart said the addition of the postgraduate department in oral surgery would not necessitate the addition of new members to the faculty. Ralph W. Edwards, instructor in operative surgery, will have charge of the new department.

Bills Introduced: Bill H. 73 proposes to forbid the sale or other distribution of acetylsalicylic acid, carbolic acid or iodine, except on the prescription of a licensed physician, dentist or veterinarian. Bill H. 133 proposes to require that all drugs and chemicals, in whole or in part of coal tar origin, intended for human medication, shall, except when prescribed by a licensed physician, be plainly labeled with their true English names and as being of coal tar origin. Labels must include statements of the dangerous effects and give the names of at least two antidotes.

NEW YORK

January Meeting: January 14, the Second District Dental Society met for the regular scientific meeting. Several members were presented for special honor: Thaddeus P. Hyatt, because he is retiring from active management of the dental division of the Metropolitan Life Insurance Company after many fruitful years, and because of his work in prophylactic odontotomy; Carol B. Whitcomb, because of his efforts in behalf of the preceding December meetings, the success of which is in no small part due to his tireless efforts; Shirley Dwyer, because his essay won the Hyatt Prize, and because he has done such outstanding work in children's dentistry; Edwin C. Kronman, because he is president of the Nassau County Dental Society.

Testimonial to John T. Hanks: March 4, the First District Dental Society will pay honor to John T. Hanks, retiring secretary of the society.

Gift from Carnegie Foundation: Columbia University announces a gift of $17,500 by the Carnegie Foundation for Dental Research.

Death of Alfred Owre: Alfred Owre died January 2, at Beth Israel Hospital, at the age of 64, after an illness of several months, caused by a cardiovascular disturbance. Dr. Owre was dean of the School of Dentistry of the University of Minnesota from 1905 to 1927. In 1933, he retired as dean of the School of Dental and Oral Surgery at Columbia University. Since that time, he had spent some time abroad and later resided at Cherry Hill, Pine Plains, New York, where he devoted his time to writing.

PENNSYLVANIA

Patents on Medical Discoveries Prohibited: The University of Pennsylvania recently announced the adoption of a policy prohibiting the patenting for profit by any one connected with it of any invention or discovery affecting the public health. Neither the university nor any one in its employ will be permitted to patent new drugs, processes or apparatus invented or discovered that are intended for medical or surgical use. It has never been the practice of the university to patent such discoveries, but there has never before been a definite ruling against it.

The Pittsburgh Meeting of the American Association for the Advancement of Science and Associated Societies, December, 1934: For the third successive year, the dental profession was represented actively in the affairs of the American Association through a program offered under the auspices of the American College of Dentists. The meeting opened with a very satisfactory attendance which was in excess of previous meetings. At the morning session Dr. James L. Zemsky, with the use of lantern slides, discussed "Further Study of Roentgenographically Negative Submerged Roots." Dr. J. Oppie McCall delivered a paper entitled "The Modern Search for the Philosopher's Stone," which was illustrated by lantern slides. Dr. John S. Oertel spoke on "Morphological Changes of Bacteria Induced by Ultra-Short Wave Radiation." A discussion entitled "Changes in the Dental Pulp and Surrounding Calcified Tissues," illustrated by lantern slides, was offered by Dr. Warren Willman. "The Tripping Action of Bar Clasps—A Comparative Physical Analysis of Retentive and Stabilizing Functions of Clasps," amplified by the use of a lantern, was presented by Dr. Eugene R. Stone. A presentation, "Rootless Teeth," by Drs. E. G. Meisel, J. C. Eselman and W. F. Swanson then engaged the attention of the audience. In the afternoon a paper on "Motion Picture Studies of the Eruption of Teeth and Developmental Growth of the Face," illustrated by lantern slides, was presented by Dr. B. Holly Broadbent. Dr. L. E. Blauch (American Association of Dental Schools, Chicago) discussed "The Changing Dental Curriculum." Because of the present status of the dental curriculum Dr. Blauch's presentation was received with much interest and proved quite instructive. Dr. Raymond J. Nagle offered a treatise of timely concern to the modern dental practitioner. He spoke on "Galvanism in the Mouth." "A Precise Quantitative Roentgeno-Densitometric Study of the Changes in Teeth Due to Attrition"

was presented by Dr. Grant van Huysen. Dr. Basil G. Bibby spoke on, and illustrated with the use of a lantern, "Variations in the Nature of the Enamel Surface." Dr. H. E. Friesell then read a paper prepared by Dr. John L. Boots (Seoul, Korea) on "A Chinese Skull of the Second Century." It is heartening to all actively interested in the new relationship to find a growing sense of responsibility on the part of our dental schools, educators and scientists in the solution of dentistry's problems, especially those pertaining to its biological phases—so closely related to good health. The program presented brought a realization that dentistry is no longer solely concerned in developing the mechanical aspects of its procedures. That older idea has been displaced by the newer effort to discover the nature of conditions, factors and influences that maintain health, that induce deficiency, or that afford the most effectual means to prevent, control or cure disease.—*Science*, Feb. 1, 1935.

RHODE ISLAND

Dean Cogan Honored: William N. Cogan, veteran dean of the School of Dentistry at Georgetown University, Washington, was awarded the scroll bestowed annually by the Rhode Island State Dental Society for meritorious service in the profession at the fifty-sixth annual meeting and banquet held January 23 in the Biltmore Hotel.

TENNESSEE

Bills Introduced: Bill S. 83 proposes to create a council of public health, which "shall approve all the rules and regulations formulated by the department of public health," the council to consist of three licensed physicians, one licensed dentist, one sanitary engineer, one member of the Tennessee Congress of Parents and Teachers, one member of the Tennessee Federation of Women's Clubs, one educator and one member of the American Legion Auxiliary, Department of Tennessee.

Bills Introduced: Bills S. 30, H. 45 and H. 48, to reorganize the department of public health, propose that the board of health shall consist of nine members, six of whom shall be licensed physicians, one a licensed dentist, one a licensed pharmacist and one a member of the Tennessee Congress of Parents and Teachers and the Tennessee Federation of Women's Clubs. The medical members of this board are to be appointed by the governor from a list of six from each grand division of the state, certified to the governor by the house of delegates of the Tennessee State Medical Association.

WASHINGTON

State Clinic: The Washington State Dental Society held its Mid-Winter Clinic in February. This is the third meeting of its kind, the first having been held Feb. 6, 1932, under the leadership of C. T. Fleetwood.

FOREIGN

Educational Improvements in Mexico City: The government of Mexico celebrated the anniversary of the Mexican revolution, November 20, with the following ceremonies: 1. The inauguration of a grammar school in Belem with a capacity for 10,000 children. The establishment of this school symbolizes the trend of the government to prevent the spreading of evil by giving the new generation education, an opportunity not previously provided to the people. Nowadays schools are opened all through the country. It shows also the control of the government on crime, which permitted the demolition of the old dark Belem jail and the construction, on the same grounds, of a modern school. The Belem jail from colonial days until its demolition was a focus of epidemic typhus, which frequently spread all over the city, and a breeding place for rats, a large percentage of which were either sick or heavily infested by *Rickettsia prowazeki*. 2. The inauguration of improvements at the Juarez Hospital. The old church of San Pablo, joined to the hospital, was reconstructed and divided into several entirely independent departments: an assembly hall with a medical library, a large chapel, an amphitheater for necropsies, a laboratory, and refrigeration chambers accommodating twenty cadavers. In

the hospital, wards were provided for emergency patients, a hair-dressing room was opened, baths were installed, offices were supplied, for physicians and for consultation, and departments inaugurated for the treatment of diseases of the eyes, nose and throat and for stomatology, gynecology, obstetrics, the digestive tract, bones and joints, neurosurgery, urology, x-rays and laboratory work. 3. Unveiling of a memorial plate in honor of Benito Juarez. —*J.A.M.A.*, Jan. 12, 1935.

Teeth of School Children: The school medical inspectors of the municipal schools, in their recent report, speak strongly as to the number of dental cases, and as to the absolute indifference shown by the parents when their attention is drawn to it. Most of them think it is hereditary—they themselves had bad teeth, and their children also must suffer. Of 1,500 girls examined, only 432 had satisfactory teeth; and the same proportion was found also in boys. The lack of interest taken as to cleanliness and preservation of teeth is the more regrettable when it is stated that half of the children leaving school and suffering from dental caries were yet in such a condition that their teeth could be saved at but little expense. Conservative dentistry, however, is unknown among the children.—Budapest Letter, *J.A.M.A.*, Feb. 2, 1935.

Dental Advertising in the United States: Objectionable advertising by persons practicing dentistry has been dealt with in this country under the disciplinary powers of the Dental Board, but, in the absence of any such authority, it persists in the United States despite strenuous efforts by the more ethical members of the profession to eradicate it. The exceptional Act of the New Jersey Legislature prohibiting advertising by dentists in that state seems likely to be tested as to its validitiy by a certain Dr. Levine, who continues to publish blatant announcements in the Hudson Press, as a challenge to the authority to revoke his license to practice. The attempts of American practitioners to remove a method of attracting patients, for some time considered improper and unnecessary by their confrères on this side of the Atlantic, will be watched with sympathetic interest.—*British D. J.*, Jan. 15, 1935.

Deaths

Aitkin, Thomas Knox, Valley Falls, Kan.; Washington University School of Dentistry, 1867; died December 22; aged 89.

Borgmeier, Carl H., Sault Ste. Marie, Mich.; University of Michigan, School of Dentistry, 1903; died December 24.

Delano, Robert T., Wareham, Mass.; Temple University School of Dentistry, 1879; died January 2.

Hammett, Charles W., Taunton, Mass.; Tufts College Dental School, 1890; died December 9.

Hill, Leon L., Reading, Mich.; University of Michigan, School of Dentistry, 1901; died October 9.

Krocker, William, Casper, Wyo.; Northwestern University Dental School, 1905; died January 12; aged 57.

Selwyn, Harry D., Chicago, Ill.; Chicago College of Dental Surgery, 1924; died December 29; aged 34.

Svenson, Oscar S., Worcester, Mass.; Temple University School of Dentistry, 1900; died January 1.

Taylor, Frank T., Boston, Mass.; Harvard University Dental School, 1890; died December 10.

Wilkinson, Frank H., Charlevoix, Mich.; University of Michigan, School of Dentistry, 1901; died December 17.

MISCELLANY

BOOK REVIEWS

Food and Health. By Henry C. Sherman, Mitchill Professor of Chemistry, Columbia University. Cloth. Price, $2.50. 279 pages. New York: The Macmillan Company, 1934.

There are many books on foods, ranging from those put out by faddists to more serious works by competent physicians and nutritionists. Another book about food must accordingly have a *raison d'etre.* There are few better equipped to write another book about food than Professor Sherman of Columbia University. His reason for writing another book is found in the recent advances made in that field which are of interest and of importance to the individual reader, and because the time has arrived when it is possible to summarize for the intelligent reader the essentials of the advances and the nutritional aspects of the food problem. Professor Sherman has written a book that should demand the attention of all who are interested in food, not for the cure of disease, but rather to give that quality of health which as been described as buoyant, as distinguished from merely passable health. The titles of the twenty chapters indicate that Professor Sherman has followed both the historic and the physiolologic method in treating of his subject. He starts with food as fuel for the energy needs of the body, from whence the reader is taken to the fundamentals of the physiologic act of digestion and a discussion of proteins and the mineral elements, and then into the vitamins. But fortunately for the reader, the book is not a series of isolated chapters on these broad subjects. One is struck by the fact that no single element stands by itself in giving the buoyant health which may be derived from the proper use of food. Calories, proper distribution of carbohydrates, fats and proteins with the various minerals and vitamins are necessary to derive the most from food. Fortunately, too, for the reader, Professor Sherman finds all of these in our common foods. He is too well trained a scientist to set up any single food or group of foods as a fad. One can find the elements of buoyant health in food which has been used by Americans for generations. Professor Sherman emphasizes the desirability of "whole foods." He points out that if milk and related products formed the larger part of our dietary, many indefinable ills might be obviated, and, of no less importance, that these foods are among the most inexpensive. This is not mere theorizing: its practicability has been established by many experiments on animals and human beings. Appendices list the distribution of calories, calcium, phosphorus, vitamins, etc., in appropriate tables. For those who want to apply the new knowledge of nutrition, three samples of diets are given. The book is written in language that is lively and the temptation is great to quote various paragraphs in which good sense with fine expression is found. For example: "Many fruits and vegetables have also another valuable property, especially when eaten raw, in that the chewing of their fiber in the presence of the mild acids which the fruits and vegetables naturally contain is extremely effective in preventing the retention of pasty particles or mucus upon the teeth, while the acid also stimulates the flow of the saliva and of the gastric juice. Thus the digestive process is helped and the mouth is left in the best possible condition. Hence the great wholesomeness of raw fruit or fruit salad as a desert, or of the eating of some celery or raw apple at the very end of (or directly after) a meal."

Again, a body blow for those who see a sort of health in little tablets of calcium phosphate:

"But at present science does not justify the exploitation of a food on the ground

that its phosphorus is contained in any particular form of organic combination: for it is known that nutrition can be satisfactorily maintained when practically all of the food phosphorus is in the form of simple mineral phosphate, and it is believed that the organic compounds of phosphorus which many foods contain are so thoroughly split by the digestive process that their phosphorus is actually absorbed from the intestine chiefly as simple phosphate. Hence, nutritional needs for phosphorus and the values of foods as sources of phosphorus are now commonly discussed without (ordinarily) any feeling of need to complicate the discussion by discrimination as to the precise form or forms of chemical combination in which the phosphorus is presented by the food."

What dentist is not interested in food and what it may or may not do for the teeth? Unfortunately, the earnest inquirer has been bombarded with a great deal of information on foods—unsound and frankly commercial; yet he conscientiously desires to give to his patients honest information. Shall he depend on the biased commercial appeals or turn to the more technical treatises? In many cases, he has neither the time nor the training for this. "Food and Health" provides one of the best introductory books on the subject that has come to the attention of this reviewer. It deserves hearty encouragement from the dental profession.

SAMUEL M. GORDON.

Manual of Fixed Bridge Work. By Karl W. Knapp, Associate Professor in charge of the Crown and Bridge Department, College of Dentistry, New York University. New York University Press, Washington Square East, New York City. Price, $3.00.

This book brings its message within the reach and understanding of the general practitioner as few books do. Fortunately, the subject lends itself to illustrations better than most, although there is enough explanation given to clarify the more intricate spots. No discussion of comparative values of fixed and removable bridges is given as none is needed, the answer to that question depending on the diagnosis. Ample diagnostic illustration is given to base the practices of most men. Teeth in all sorts of positions are depicted and preparations outlined. Only live teeth are considered for obvious reasons, which is a telling indictment of pulpless teeth, a passing deduction. No step in the process of bridge construction is omitted. Cavity preparation, pattern making, investing, heating and casting are treated in detail. Nothing of importance pertaining to inlays, crowns and pontics has been overlooked, and yet the book is serviceable in size, totaling only 167 pages. From the illustrations, a practitioner can readily get the full value of the author's intent. Knapp assumes that his reader will do his own laboratory work, an assumption which doubtless afforded him his greatest disappointment. The book is a powerful inducement to that very end. All in all, this is a thorough and workman-like text, practical and every line to the point.

T.

One Hundred and Fifty Years of Publishing 1785-1935. By Lea & Febiger, Philadelphia.

This small book beautifully bound tells the story of the house of Lea and Febiger, known to physicians and dentists as publishers of medical and dental texts. In addition to biographical sketches of the men who headed the firm from its beginning, four years before the Constitution of the United States was adopted, it presents bits of history that catch the attention and hold it. At first engaged in the publication of general literature, Lea & Febiger, then Matthew Cary, publisher of Carey's *Pennsylvania Evening Herald*, printed the Douay and Authorized Version of the Bible, Weems' biographies of Washington, the Waverly Novels, James Fenimore Cooper's novels and the works of Washington Irving and Edgar Allen Poe. Also they reprinted the Pickwick Papers. The firm early undertook medical publication, producing Bell's "Anatomy," Hutin's "Physiology," and later (1859) Gray's "Anatomy." In 1820, it founded the *Philadelphia Journal of the Medical and Physical Sciences*, now called the *American Journal of Medical Science*, with one exception

the oldest medical journal in the English language. With the development of medical science, this firm gave its attention entirely to that field. The story fascinates from preface to final page. Photographs and facsimilies give it a delightful intimacy and a similar enjoyment. T.

The Journal of the Canadian Dental Association, Volume I, No. 1, January, 1935. This is a new name on the roster of Journalism. It marks the end of a period of spasmodic effort, with varying ownership and managements. The dentists of Canada gird their loins to sponsor and publish a journal that is their very own, a journal that shall represent them, be their voice, their front to the world. The new journal is in reality the *Dominion Dental Journal* newly named and managed. That journal dominated the dental literary field for thirty-five years, during which time A. E. Webster was its editor. He continues as honorary editor of the new journal, a graceful recognition of his loyalty to the interest of the profession. The comprehensiveness of the new publication is indicated by its double title. M. H. Garvin, of Winnipeg, is editor in chief, and Philippe Hamel, of Quebec, is editor of the French section. The enthusiasm with which the new enterprise begins is assuring. The president, G. L. Cameron, exclaims "Here begins a new chapter in the history of dentistry in Canada." He says practically "100 per cent of all ethical dentists, now numbering 4,000, are members in good standing of the Canadian Dental Association," a rare tribute in itself to the intelligence and aspiration of the dentist of Canada. Likewise is it evidence of a rare courage for such a number to assume the responsibility that is outlined in the salutation by the new editor. Canada has imitated the states in its journalistic history. Ten magazines have come, and, in some instances, gone, while the profession bided the time when it could speak for itself. The new journal has an opportunity it doubtless will not overlook to learn from the successes and failures of those that have preceded as well as those that run concurrently with it. T.

Index of the Periodical Dental Literature. The twelfth volume of the periodical index covers the years 1906-1910, which, with the preceding eleven, completes the series to 1929. This prodigious undertaking was assumed by A. D. Black as editor under the auspices of the American Association of Dental Colleges, the A.D.A., the Research Commission of the A.D.A., the British Dental Association, the Canadian Dental Association, the New Zealand Dental Association and the Society of Dental Science of New South Wales. The book is published by the Dental Index Bureau, 381 Linwood Avenue, Buffalo, New York, and Henry Kempton, 263 High Holborn, London, England.

Compensation in the Professions. By L. W. Bartlett, Professor of Education, George Williams College, Chicago, assisted by Mildred B. Neel, Associate in Research. Published by the Association Press, New York City, 1933. Price, $2.00.

The enterprise of living together cooperatively so that the common needs of society be administered competently is the theme of this book. It analyzes the criteria of compensation of professional workers. The problem of adjusting incomes threatens to submerge professions for the reason that they have only a slight philosophy of compensation. The factors of compensation are enumerated for each and discussed. The assumption that social well-being requires such service as education and that health be taken out of the realm of barter and exchange is predicated. The table of contents includes an analysis of supply and demand, the factors affecting both, comparison with other professional workers, comparison of incomes and factors in that comparison, services, needs and criteria of compensation. The professions include dentistry, engineering, law, librarianship, medicine, missionary, social work, teaching and Y.M.C.A. secretaryship. In the table of incomes, dentistry ranks fourth, medicine, law and engineering being ahead. The study is marked by clear, unbiased analysis and readable statement. Tables are numerous, to sustain the clarity of the argu-

ment. The final chapter is devoted to a bibliography of forty pages.

T.

DR. MORENO ON HEALTH INSURANCE

Stigmatizing the health insurance bill pending before the state legislature as a measure under which patients would get poor medical care, and physicians would degenerate into callous machines, Dr. Jacob L. Moreno, New York City, appeared to enter his protest against the law. He told members of the legislative committee of the Medical Society of the State of New York his experience during six years under health insurance in Austria.

"All such schemes," he said, "operate to make physicians into mass-production machines turning out standardized treatment to patients. Every patient is an individual medical problem. Health insurance cheats both the patient and the doctor. In the name of trying to advance human welfare, such measures actually retard progress."

Dr. Moreno is director of research at the New York State Training School for Girls, Hudson, N. Y., and adviser of the Subsistence Homestead Division, Department of the Interior, Washington, D. C.

"I know from experience with the actual reality," said Dr. Moreno, "that no matter how rosy the picture of ideal care for the poor that is presented by such schemes for health insurance, in practice they do not work. They cannot work, because they fail to take account of factors in human relations which are indispensable to the practice of the healing art.

"No physician," added Mr. Moreno, "is capable of properly treating the large number of patients sent him under health insurance. So he is forced to evolve some mass-production plan of operating his office to run people through his mill as fast as possible. A quick look, a stock prescription, a pat on the back, and out the door.

"The 'rush' system of handling patients is inevitable. When the technique of getting them in and out fast enough is perfected the doctor begins to lose that intangible 'something' which is vital to both himself and his patient—his morale. I do not know any doctor who remained long at this sort of practice in Austria who did not become hardened. A doctor's personal interest in his patient is essential. The response he makes emotionally to the trust reposed in him is important. If the patient comes to the doctor because of confidence in him and not merely because he is an insurance doctor, interest and insight are quickened. Mutual free choice is basic to good medical care.

"Every person's capacity to expand emotionally, and to sustain a confidential relationship, is limited. A physician may be able to maintain a keen mental activity while examining a few cases a day, but after his limit is reached, the power to sustain the faculties on a high plane wanes, until, finally, when the last case of a long line is reached, the patient becomes merely a serial number on a piece of paper. Health insurance forces on the doctor an utterly impossible human task—to sustain a genuine personal interest in all the individuals of a miscellaneous crowd at his door.

"The insurance doctor does the best he can, but patients suspect they would get better attention if they came to him during his private office hours when he could give them more time. This is a distinct and definite injury to the character of the physician. He must hurry through his insurance patients so that he can have plenty of his best self left to take care of his private patients. This is a corrupting influence. He knows he has not lived up to the highest tenets of his profession to give his best to every patient who comes to him. He has been forced by circumstances enacted by a law to do less than his best by some of his patients, and even his best with the few who see him privately gradually becomes not so good as it was once.

"Nobody who has not seen such schemes in practice as I have can realize how odious they are. They destroy everything that makes the healing art effective. A new face comes between the doctor and the patient, that of an inspector or supervising physician, or an insurance bureau bookkeeper, questioning this and that particular, with-

out the intimate understanding derived from having seen and known the patient. At best, the real patient, the one for whom the mass production doctor is working, whom he must please if he is to live, is not the sick man, but an adding machine in the office of a bureaucrat who pays the fees out of an insurance fund. This man doesn't care whether the patient lives or dies, only how much he costs the fund. And his influence is exerted only in the direction of economy and other externals.

"Supervisors are needed in health insurance organizations. A good controller or supervisor who brings in many complaints against doctors is a good supervisor—he is headed for promotion because medical practice has now become a business instead of a profession. Thus do we destroy a truly healing relationship of which trust and confidence is the basis, and substitute a chain-store, cut-rate imitation, which corrodes curative values needed to heal the sick.

"The system which we now have in the United States is not perfect. But I know from personal experience that the conditions imposed by health insurance are far worse. Health insurance is a type of socialized medicine. It is impossible to socialize the doctor unless the business man, the banker and the lawyer are socialized too. Until the time comes, if it ever does come, when we have communism or some form of collectivism, health insurance simply will not work. Though it applies only to the lower income groups, those groups will always feel they are getting less than they ought to get, even if the doctors are men of quality having lucrative private practices in addition to their insurance practice. Like all half-way measures, it will fail, despite the well-meaning altruism of those who sponsor such legislation. They do not realize, as the physician does, who has practiced under such a system, how destructive it is to quality in medical care.

"Letters which have come to me recently from former patients in Austria state that conditions are no better now than when I left five years ago, but are worse, if anything."

CORRESPONDENCE

Saving of Amalgam Scrap and Mercury

To the Editor:

Having seen the item about selling old amalgam scrap to raise money for the A.D.A. Relief Fund, in the February issue of The Journal, I wish to add this suggestion: If the mercury expressed when amalgam dies are made were saved by squeezing through chamois into a paper box, and were collected through central agencies as suggested by Vern D. Irwin, I believe that it could be sold to refiners together with the amalgam scrap for a very favorable price, because of the little expense that they would be put to in collecting it. Thus a considerable amount might be added to the Relief Fund. I have 2 or 3 pounds of such mercury on hand which I have saved in the hopes of some day finding a channel through which I might dispose of it.

O. T. Rule,
184 Bedford St.,
Stamford, Conn.

Feb. 5, 1935.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, New Orleans, La., November 4-8.

American Association of Dental Schools, Chicago, March 18-20.

American Dental Society of Europe, London, July 31-August 3.

American Society of Orthodontists, New York City, April 30-May 3.

American Congress of Physical Therapy, Madison, Wis., March 12.

Belgian National Dental Congress, Brussels, August.

Dental Alumni Association, American University of Beirut, Beirut, Lebanon, June.

Five State Postgraduate Clinic, Washington, D. C., March 18-20.

Thomas P. Hinman Midwinter Clinic, Atlanta, March 18-19.

International Association for Dental Research, Chicago, March 16-17.

International Congress of Stomatology, Bologna, April 14-19.

International Dental Congress, Vienna, Aug. 2-9, 1936.

Kansas City-Western Clinic Association, Kansas City, Mo., March 7-8.

National Board of Dental Examiners, January 11-12; May 24-25.

New York Society of Orthodontists, New York City, April 30-May 3.

New York State Dental Hygienists Association, Saranac, June 12-15.

University of Buffalo School of Dentistry Alumni Association, Buffalo, March 6-8.

American Dental Assistants Association, New Orleans, November 4-8.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

STATE SOCIETIES

April

Alabama, at Birmingham (16-18)
California, at Oakland (8-10)
Kansas, at Wichita (22-24)
Kentucky, at Paducah (1-3)
Louisiana, at New Orleans (18-20)
Massachusetts, at Boston (29-May 2)
Michigan, at Detroit (22-24)
Mississippi, at Jackson (22-24)
New Jersey, at Atlantic City (24-25)
Texas, at Waco (15-18)
Wisconsin, at Milwaukee (16-18)

May

Arkansas, at Little Rock (13-15)
Connecticut, at Waterbury (8-10)
Georgia, at Atlanta (13-15)
Illinois, at Quincy (14-16)
Indiana, at Indianapolis (20-22)
Iowa, at Des Moines (7-9)
Maryland, at Baltimore (6-8)
Montana, at Lewiston (9-11)
Nebraska, at Omaha (20-23)
Pennsylvania, at Altoona (7-9)
South Dakota, at Huron (13-14)
Tennessee, at Nashville (14-16)
Vermont, at Burlington (15-17)
West Virginia, at Parkersburg (20-22)

June

Maine, at Augusta (21-22)
New Hampshire, at Rye Beach (26-27)
New York, at Upper Saranac Lake (12-15)
North Carolina, at Blowing Rock (17-19)
Oregon, at Portland (5-8)

July

Southern California, at Long Beach (8-12)
Virginia, at Hot Springs (1-3)

November

Louisiana, at New Orleans (4-8)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

STATE BOARDS OF DENTAL EXAMINERS

Arkansas, at Little Rock, June 17-20. Clarence W. Koch, 817 Donaghey Bldg., Secretary.

California, at San Francisco, May 27; Los Angeles, June 24. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Connecticut, at Hartford, June 26-29. Almond J. Cutting, Southington, Secretary.

Florida, at Jacksonville, June 24-29. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Kentucky, June 11-14. Robert L. Sprau, 970 Baxter Ave., Louisville, Secretary.

Indiana, at Indianapolis, June 18-21. J. M. Hale, Mt. Vernon, Secretary.

Iowa, at Des Moines, May 27-30. Hardy F. Pool, Mason City, Secretary.

Maine, at Augusta, June 24-26. Alton H. Swett, 192 State St., Portland, Secretary.

Mississippi, at Jackson, June 18-20. T. Ford Leggett, Laurel, Secretary.

New Jersey, at Trenton, June 24-29. J. C. Forsyth, 148 W. State St., Trenton, Secretary.

Ohio, at Columbus, June 24. Morton H. Jones, 1553½ North Fourth St., Columbus, Secretary.

Tennessee, at Nashville, May 14-16. E. J. Justis, Exchange Bldg., Memphis, Secretary.

Virginia, at Richmond, June 11. John M. Hughes, 715 Medical Arts Bldg., Richmond, Secretary.

West Virginia, at Charleston, June 24-26. H. C. Hill, Charleston, Secretary.

KANSAS STATE DENTAL ASSOCIATION

The sixty-fourth annual meeting of the Kansas State Dental Association will be held at the Allis Hotel, Wichita, April 22-24. A large display of exhibits by dental manufacturers will be presented throughout the entire meeting.

FRED A. RICHMOND, *Secretary*,
305 Federal Reserve Bldg.,
Kansas City.

KENTUCKY STATE DENTAL ASSOCIATION

The sixty-sixth annual meeting of the Kentucky State Dental Association will be held at the Hotel Irvin Cobb, Paducah, April 1-3.

J. H. FULLENWIDER, *Secretary*,
1101 Heyburn Bldg.,
Louisville.

LOUISIANA STATE DENTAL SOCIETY

The regular meeting of the Louisiana State Dental Society will be held at the Roosevelt Hotel, New Orleans, April 18-20.

MALCOLM E. KAFFEE, *Secretary*,
711 Medical Arts Bldg.,
Shreveport.

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The next examination of the Arkansas State Board of Dental Examiners will be held at the Marion Hotel, Little Rock, June 17-20; fee, $35. Applications must be filed at least ten days prior to the date of examination. Address all communications for further particulars to

CLARENCE W. KOCH, *Secretary*,
817 Donaghey Bldg.,
Little Rock.

BOARD OF DENTAL EXAMINERS OF CALIFORNIA

The next examination to be conducted by the Board of Dental Examiners of California will be held in San Francisco, commencing May 27, and in Los Angeles, commencing June 24. For information regarding these examinations, address

KENNETH I. NESBITT, *Secretary*,
450 McAllister St.,
San Francisco.

CONNECTICUT DENTAL COMMISSION

The Connecticut Dental Commission will meet in Hartford, June 26-29, for examination of applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before it. Applications should be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

ALMOND J. CUTTING, *Recorder*,
Southington.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

Examinations for license to practice dentistry or dental hygiene in Florida will be held in Jacksonville, June 24-29. For information and application blanks, address

H. B. PATTISHALL, *Secretary*,
351 St. James Bldg.,
Jacksonville.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

The Kentucky State Board of Dental Examiners will meet June 11-14.

ROBERT L. SPRAU, *Secretary*,
970 Baxter Ave.,
Louisville.

MAINE BOARD OF DENTAL EXAMINERS

The next meeting of the Maine Board of Dental Examiners for examination of applicants for licensure to practice in Maine will be held June 24-26, at the State House, Augusta. For further information, applications, requirements, etc., address

ALTON H. SWETT, *Secretary*,
192 State St.,
Portland.

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

The Mississippi State Board of Dental Examiners will meet at Jackson, June 18-20.

T. FORD LEGGETT, *Secretary*,
Laurel.

OHIO STATE DENTAL BOARD

The next examination of the Ohio State Dental Board will be held at the College of Dentistry, Ohio State University, Columbus, the week beginning June 24. All applications must be in the hands of the secretary at least ten days before the date of examination. For further information, apply to

MORTON H. JONES, *Secretary*,
1553½ North Fourth St.,
Columbus.

TENNESSEE STATE DENTAL ASSOCIATION

The Tennessee State Dental Association will hold its sixty-eighth annual meeting May 14-16 at the Hermitage Hotel, Nashville.

E. J. JUSTIS, *Secretary*,
Exchange Bldg.,
Memphis.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning June 11. Applicants are required to present a certificate from the Virginia State Board of Education showing that they have had one year of academic education equal to one year of college work and must be prepared to do any kind of practical or operative work necessary in the general practice of dentistry. The theoretical examination covers subjects usually found in a complete dental curriculum. Applications, with fee and photograph, must be filed complete fifteen days before the examination. For application blanks and further information, apply to

JOHN M. HUGHES, *Secretary*,
715 Medical Arts Bldg.,
Richmond.

WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the West Virginia State Board of Dental Examiners will be held June 24-26 at Charleston. Applications, with necessary fee, must be in the hands of the secretary at least ten days prior to the date of examination. Address all communications to

H. C. HILL, *Secretary*,
Charleston.

NEW YORK SOCIETY OF ORTHODONTISTS

The fourteenth annual meeting of the New York Society of Orthodontists will be held in conjunction with that of the American Society of Orthodontists at the Waldorf-Astoria Hotel, New York City, April 30-May 3. A business session for the election of officers, etc., will be held May 2, at a noonday luncheon.

FRANKLIN A. SQUIRES, *Secretary*,
Medical Centre,
White Plains.

JOINT MEETING OF MONTEFIORE HOSPITAL DENTAL DEPARTMENT AND TUFTS DENTAL CLUB OF NEW YORK

A joint meeting of the Montefiore Hospital Dental Department and the Tufts Dental Club of New York will be held at the hospital March 7 at 8:30 p. m. James C. Healy, assistant professor of oral medicine, Tufts Dental School, will speak on "The Influence of Various Allergies and Endocrine Glands on the Dental Structures." Discussion will be by J. Harkavy, M.D., and Sidney Sorrin, D.D.S.

M. HINENBURG, *Assistant Director,*
Montefiore Hospital,
Gun Hill Road, near Jerome Ave.
New York City.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

The thirteenth annual meeting of the International Association for Dental Research, now consisting of twenty-six sections in eight nations, will be held March 16-17, at the Hotel Stevens in Chicago, in coordination with the annual meeting of the American Association of Dental Schools, March 18-20. Papers on research in dentistry and allied fields will be presented chiefly by workers in laboratories and clinics of dental and medical schools in North America and Europe. Each session will be open to all who may be interested. Copies of the official program may be obtained after March 6 at the office of the secretary, International Association for Dental Research, 632 West 168th St., New York City.

AMERICAN CONGRESS OF PHYSICAL THERAPY

The American Congress of Physical Therapy announces a one day session of its Mid-Western Section, to be held in the auditorium of the Service Memorial Institute, Madison, Wis., March 12. The morning session will be devoted to hospital clinics and the afternoon session to scientific papers. The evening program will be conducted under the joint auspices of the section and the Dane County Medical Society. For program, address

MARION G. SMITH, *Executive Secretary,*
30 N. Michigan Ave.,
Chicago, Ill.

DENTAL ALUMNI ASSOCIATION AMERICAN UNIVERSITY OF BEIRUT

The Dental Alumni Association of the American University of Beirut will hold its fifth biennial dental conference and celebrate the twenty-fifth anniversary of the founding of the first dental school in the Near East, at Beirut, Lebanon, during the university commencement week in June. All ethical graduate dentists of the Near East and others who may be on tour in this part of the world are cordially invited to this meeting. American and European dental manufacturers are invited to lend their support by presenting exhibits as at former meetings.

K. G. TABOURIAN, *Secretary.*

INTERNATIONAL CONGRESS OF STOMATOLOGY

The second International Congress of Stomatology will be held in Bologna, Italy, April 14-19. There will be an exhibit of dental materials, industrial novelties, books on stomatology and various instruments, and antiquated books and prints. In addition to essays and clinics, there will be a dinner, concert of Italian music performed by celebrated artists and a trip to Ravenna, to Dante's tomb and the monuments of Byzantine art. After the congress, Florence, Rome, Naples, Palermo, Genoa and the Italian Riviera will be visited. Those attending the congress will be granted a reduction in railway fares, free entrance to museums, picture galleries and libraries, receive the publications of the congress free and receive reduced rates on tramways, the airway of Bologna and to theaters and cinemas. Those wishing to attend or take part in the program should apply to a national group of the A.S.I. or later to the Organizing Committee of the Congress, 59 Via s. Vitale, Bologna.

Do Not Forget . .

that a trip to New Orleans

November 4 to 8, 1935

will greatly aid in solving

Your Dental Problems

An A. D. A. Convention

furnishes

The Best Investment
A Dentist Can Make,

not only in financial return
but in intellectual uplift.

Why Not Combine Material Benefit
with Mental Stimulation?

COME TO NEW ORLEANS IN NOVEMBER

RECENT BOOKS WORTH BORROWING* OR BUYING†

from the

LIBRARY BUREAU

of the

AMERICAN DENTAL ASSOCIATION

212 E. Superior St., Chicago, Ill.

Adams, C. W.	Your teeth and their care. St. Louis, Mosby, 1932. $1.25. Alfred David Lenz system of lost wax casting. New York, National Sculpture Soc., 1933. $2.00.
American Pharmaceutical Assn.	Pharmaceutical recipe book. Baltimore, Md., American Pharmaceutical Assn., 1929. $5.00.
Anderson, G. M.	Orthodontic laboratory manual. St. Louis, Mosby, 1930. $2.00.
Anthony, L. P.	Dental terminology. Chicago, American Dental Assn., 1930. (Free.)
Appleton, J. L. T., Jr.	Bacterial infection with special reference to dental practice. Philadelphia, Lea & Febiger, 1933. $7.00.
Appleton, J. L. T., Jr., & Bryant, C. K.	Laboratory guide in bacteriology. Philadelphia, Lea & Febiger, 1928 $2.75.
Asgis, A. J.	Outline of dental socio-economics. New York, Allied Dental Council, 1934. $1.00.
Bartels, H. A.	Outline of bacteriology. New York, W. A. Broder, 1929. $2.00.
Bartlett, L. W., & Neel, Mildred B.	Compensations in the professions. New York, Association Press, 1933. $2.00.
Beck, Dorothy F.	Cost of equipping a dental office. Chicago, University of Chicago Press, 1932. $1.00.
Berger, Adolph	Principles and technique of oral surgery. Brooklyn, Dental Items of Interest Pub. Co., 1927. $7.00.
Berger, Adolph	Principles and technique of the removal of teeth. Brooklyn, Dental Items of Interest Pub. Co., 1929. $7.50.
Beust, T. B.	Dental histology and embryology. Philadelphia, Saunders, 1934. $3.00.
Blayney, J. R.	Dental pharmacology and therapeutics. St. Louis, Mosby, 1934. $4.50.
Blunt, Katharine, & Cowan, Ruth	Ultraviolet light and vitamin D in nutrition. Chicago, University of Chicago Press, 1930. $2.50.
Bödecker, C. F.	Elementary histology for dental hygienists. New York, W. A. Broder, 1929. $2.00.
Bogert, L. J.	Nutrition and physical fitness. Philadelphia, Saunders, 1931. $3.00.
Bosworth, H. J.	Dental economics. Chicago, Bosworth Economic Institute, 1932. $5.00.
Bowler, Inez	Elementary manual of dental library practice. Ann Arbor, Univ. of Michigan Press, 1932.
Box, H. K.	Necrotic gingivitis. Toronto, University of Toronto Press, 1930. $1.00.
Box, H. K.	Treatment of the periodontal pocket. Toronto, University of Toronto Press, 1928. $1.00.

*Books may be *borrowed* by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume to be sent at one time should accompany all requests for books. This will be refunded on return of books.

†If you wish to *purchase* books, indicate plainly which books you desire and enclose check with order.

Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1932. $4.00.
Broderick, F. W.	Dental medicine. St. Louis, Mosby, 1928. $6.00.
Broderick, R. A.	Dental bacteriology. Outlines of dental science. Vol. 2. Edinburgh, Livingstone, 1926. $2.50.
Brothers, E. D.	Dental jurisprudence. St. Louis, Mosby, 1928. $2.25.
Brown, A. J.	Dental metallurgy. Outlines of dental science. Vol. 11. New York, Wood, 1928, $2.50.
Brown, W. L.	Endocrines in general medicine. St. Louis, Mosby, 1927. $3.00.
Buckley, J. P.	Modern dental materia medica, pharmacology and therapeutics. Philadelphia, Blakiston, 1926. $6.00.
Bulleid, Arthur	Textbook of bacteriology for dental students. St. Louis, Mosby, 1927. $4.50.
Bunce, E. W.	Bunce-Kanouse full denture technic. Chicago, Coe Laboratories, Inc. 1929. $1.25.
Bunting, R. W.	A textbook of oral pathology for students and practitioners of dentistry. Philadelphia, Lea & Febiger, 1929. $7.00.
Burchard, H. H., & Inglis, O. E.	Textbook of dental pathology and therapeutics for students and practitioners. Philadelphia, Lea & Febiger, 1926. $7.50.
Burkhart, H. J.	Care of the mouth and teeth. (National Health Series.) New York, Funk & Wagnalls, 1928. $0.30.
Buxton, J. L. D.	Dental pathology. Outlines of dental science. Vol. 7. New York, Wood, 1927. $2.50.
Buxton, J. L. D.	Dental surgery. Outlines of dental science. Vol. 8. New York, Wood, 1927. $2.50.
Cahn, L. R.	Basic principles of general and oral pathology. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1929. $4.50.
Campbell, Menzies	Those teeth of yours. London, Heinemann, 1931. $1.50.
Casto, T. D.	Questions and answers on pedodontology, with glossary. Philadelphia, Author, 1932. $2.50.
Cattell, Psyche	Dentition as a measure of maturity. Cambridge, Harvard University Press, 1928. $1.00.
Churchill, H. R.	Human odontography and histology. Philadelphia, Lea & Febiger, 1932. $4.50.
Clark, C. A.	Dental radiography. Outlines of dental science. Vol. 5. New York, Wood, 1926. $2.50.
Cogswell, W. W.	Dental oral surgery. Pittsburgh, Penna., Dental Digest, Inc., 1932. $10.00
Colyer, J. F., & Sprawson, Evelyn	Dental surgery and pathology. New York, Longmans, 1931. $12.50.
Colyer, Stanley	Chronic infection of the jaws: a short radiological and clinical study. New York, Macmillan, 1926. $3.50.
Committee on Costs of Medical Care	Medical care for the American people. Chicago, Univ. of Chicago Press, 1932. $1.50.
Dall, William	Ground porcelain inlays. London, Henry Kimpton, 1933. $5.25.
Daukes, S. H.	Medical museum: Modern developments, organization and technical methods based on a new system of visual teaching. London, Wellcome Foundation, Ltd., n.d. (No purchase orders accepted.)
Davis, M. M.	Paying your sickness bills. Chicago, University of Chicago Press, 1931. $2.50.
Dental Board of the United Kingdom	Four lectures on "general anaesthesia." London, Dental Board of the United Kingdom, 1926. $2.00.
Dental Board of the United Kingdom	Three lectures on "dental alloys." Delivered under the auspices of the Dental Board of the United Kingdom. London, Dental Board of the United Kingdom, 1927. $2.00.
Diamond, M.	Dental anatomy. A graphic presentation of tooth forms with an original technique for their reproduction. New York, Macmillan, 1929. $3.50.

Dorrance, G. M.	Operative story of cleft palate. Philadelphia, Saunders, 1933. $6.50.
Doxtater, L. W.	Procedures in modern crown and bridge-work. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1931. $8.00.
Endleman, Julio	Special dental pathology; a treatise for students and practitioners. St. Louis, Mosby, 1927. $7.00.
Ennis, L. M.	Dental roentgenology. Philadelphia, Lea & Febiger, 1931. $6.50.
Farkasch, O.	Dilemmas of dentistry. New York, Dodd Bros., 1931. $3.50.
Federspiel, M. N.	Harelip and cleft palate. St. Louis, Mosby, 1927. $5.00.
Felcher, F. R.	Art of porcelain in dentistry. St. Louis, Mosby, 1932. $9.00.
Feldman, M. H.	Manual of exodontia. Philadelphia, Lea & Febiger, 1930. $3.50.
Ferguson, H. W.	Child's book of the teeth. Yonkers-on-Hudson, World Book Co., 1932. $0.68.
Fine, Samuel	Principles and practice of dental assistant. Worcester, Mass., Hamilton Pub. Co., 1931. $2.50.
Fischer, Guido	Local anesthesia in dentistry. Philadelphia, Lea & Febiger, 1933. $4.00.
Fish, E. W.	Experimental investigation of enamel, dentine and the dental pulp. London, John Bale, Sons & Danielsson, Ltd., 1933.
Fish, E. W.	Principles of full denture prosthesis. London, John Bale, 1933. $4.00.
Fones, A. C.	Mouth hygiene; a textbook for dental hygienists. Philadelphia, Lea & Febiger, 1934. $5.00.
Fones, A. C.	Preventive dentistry. Philadelphia, Lea & Febiger, 1925. $2.75.
Foote, J. S.	Bone as a measure of development: When and how we acquired our teeth. Chicago, American Dental Association, 1928. $4.00.
Frahm, F. W.	Principles and technics of full denture construction. Brooklyn, Dental Items of Interest, 1934. $7.00.
Franzen, Raymond	Public health aspects of dental decay in children. New York, American Child Health Assn., 1930. $1.25.
Gies, W. J.	Dental education in the United States and Canada. New York, Carnegie Foundation, 1926. (Free.)
Gillett, H. W., & Irving, A. J.	Gold inlays by the indirect system. Brooklyn, Dental Items of Interest, 1932. $8.00.
Goepp, R. M.	Dental state board questions and answers. Philadelphia, Saunders, 1928. $4.50.
Goslee, H. J.	Principles and practice of crown and bridge-work. Brooklyn, Dental Items of Interest Pub. Co., 1926. $7.50.
Gottlieb, B., & Orban, B.	Die veränderungen der gewebe bei übermässiger beanspruchung der zähne. Leipzig, Georg Thieme, 1931. Unbound, $6.50. Bound, $7.00.
Graves, Lulu G.	Foods in health and disease. New York, Macmillan, 1932. $3.50.
Greenfield, A. L.	Interpretation of dental radiograms. Rochester, N. Y., Ritter Dental Mfg. Co., 1926. $2.50.
Gregory, W. K.	Our face from fish to man. New York, Putnam, 1929. $4.50.
Gwathmey, J. T.	Textbook of anesthesia. New York, Macmillan, 1929. $7.50.
Gwinn, C. D.	Textbook of exodontia. Philadelphia, Lea & Febiger, 1927. $2.75.
Gysi, Alfred	Special teeth for cross-bite cases. New York, Dentists' Supply Co., 1928. (Pamphlet.) (No purchase orders accepted.)
Hackh, I. W. D.	Chemical reactions and their equations. Philadelphia, Blakiston, 1928. $2.00.
Haden, R. L.	Dental infection and systemic disease. Philadelphia, Lea & Febiger, 1928. $2.50.
Hall, E. M.	Pulpless tooth problems. Detroit, Mich., Dertoit Dental Manufacturing Co., 1930.
Hanau, R. L.	Dental engineering. Buffalo, N. Y., Author, 1926. (No purchase orders accepted.)
Hanau, R. L.	Hanau intraoral method vs. Gysi extraoral method. Buffalo, N. Y., Author, 1927. (No purchase orders accepted.)
Hanke, M. T.	Diet and dental health. Chicago, Univ. of Chicago Press, 1933. $4.00.

Harder, O. E.	Modern dental metallography. Minneapolis, Minn., Burgess-Roseberry Co., 1930. $3.75.
Hartman, L. L.	Teeth and the mouth. New York, Appleton, 1927. $1.50.
Head, Joseph	Everyday mouth hygiene. Philadelphia, Saunders, 1925. $1.00.
Hedstrom, Gustav	Gangrene of dental pulp and its treatment. Stockholm, Sweden, Isaac Marcus, 1927. (No purchase orders accepted.)
Headridge, Davis, & Gibson, S. K.	Dental anatomy, human and comparative. Outlines of dental science. Vol. 6. New York, Wood, 1928. $2.50.
Herbst, Emil, & Apffelsteadt, Max	Atlas and grundriss der missbildungen der kiefer and zähne. Munchen, J. F. Lehmanns, 1928. (No purchase orders accepted.)
Hertzler, E.	Technic of local anesthesia. St. Louis, Mosby, 1925. $5.50.
Hess, Walter, & Zurcher, Ernst	Anatomy of the root-canals of the teeth. New York, Wood, 1925. $5.50.
Hewer, C. L.	Recent advances in anaesthesia and analgesia. Philadelphia, Blakiston, 1932. $3.50.
Hildebrand, G. Y.	Studies in masticatory movements of human lower jaw. Berlin, Gruyter, 1931. (No purchase orders accepted.)
Hodgen, J. D.	Practical dental metallurgy. St. Louis, Mosby, 1932. $3.75.
Hogeboom, F. E.	Practical pedodontia or juvenile operative dentistry and public health dentistry. St. Louis, Mosby, 1933. $6.50.
Hyatt, T. P.	Hygiene of mouth and teeth. Brooklyn, N. Y., Brooklyn Dental Pub. Co., 1929. $1.00.
Hyatt, T. P.	Prophylactic odontotomy: A practical and simple procedure for the prevention of caries in pit and fissure cavities. New York, Macmillan, 1933. $1.50.
Ivy, R. H., & Curtis, Lawrence	Fractures of the jaws. Philadelphia, Lea & Febiger, 1931. $4.50.
Jamieson, J. D. H.	Operative dentistry. Outlines of dental science. Vol. 9. New York, Wood, 1927. $2.50.
Jerman, E. C.	Modern x-ray technic. St. Paul, Bruce Pub. Co., 1928. $5.50
Jordan, E. O.	Textbook of general bacteriology. Philadelphia, Saunders, 1931. $6.00.
Jordan, M. Evangeline	Operative dentistry for children. Brooklyn, Dental Items of Interest Pub. Co., 1927. $5.00.
Kanner, Leo	Folklore of the teeth. New York, Macmillan, 1928. $4.00.
Kells, C. E.	Dentists' own book, including a complete bookkeeping and recording system. St. Louis, Mosby, 1925. $7.50.
Kells, C. E.	Three score years and nine. New Orleans, The Author, 1926. $8.00.
Kennedy, Edward	Partial denture construction. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1928. $7.50.
Kent, E. N.	Business side of dentistry. St. Louis, Mosby, 1929. $5.00.
Korkhaus, Gustav	Moderne orthodontische therapie. Berlin, Meusser, 1932.
Kronfeld, Rudolf	Histopathology of the teeth and their surrounding structures. Philadelphia, Lea & Febiger, 1933. $7.00.
Kuttler, Yury	Mis investigaciones sobre la denticion en 15,240 ninos y 782 adultos habiendo hecho 28,557 examenes. Mexico, D. F., Facultad Odontologica de la Universidad Nacional Autonoma de Mexico, 1933.
Lee, R. I., & Jones, L. W.	Fundamentals of good medical care. Chicago, Univ. Chicago Press, 1933. $2.50.
LeGro, A. L.	Ceramics in dentistry. Brooklyn, N. Y., Dental Items of Interest Pub. Co., 1926. $7.50.
Leriche, R., & Policard, A.	Normal and pathological physiology of bone. St. Louis, Mosby, 1928. $5.00.
Leuck, Miriam S.	Study of dental clinics in the United States: 1930. Chicago, University of Chicago Press, 1932. $1.00.
Leuck, Miriam S.	Further study of dental clinics in the United States. Chicago, University of Chicago Press, 1932. $1.50.

Leven, Maurice, & Beck, Dorothy F.	Practice of dentistry and incomes of dentists in twenty states: 1929. Chicago, University of Chicago Press, 1932. $2.00.
Lindsay, Lilian	Short history of dentistry. London, John Bale, 1933. $1.50.
Livingston, Alexander	Dental histology. Outlines of dental science. Vol. 10. New York, Wood, 1928. $2.50.
Lloyd-Williams, E.	Dental mechanics: a manual for students and junior practitioners. London, Bale, 1931. $2.00.
Logan, J. D.	Dental prosthetics. Outline of dental science. Vol. 4. Edinburgh, Livingstone, 1926. $2.50.
Lucas, H. A.	Medicine for dental students. Baltimore, William Wood & Co., 1933. $2.75.
Margolis, H. M.	Conquering arthritis. New York, Macmillan, 1932. $2.00.
Marriott, W. M.	Infant nutrition: a textbook of infant feeding for students and practitioners of medicine. St. Louis, Mosby, 1930. $5.50.
Marsden, P. H.	Dental material medica. Outlines of dental science. Vol. 3. Edinburgh, Livingstone, 1926. $2.50.
Marshall, J. A.	Diseases of the teeth; their diagnosis and treatment. Philadelphia, Lea & Febiger, 1926. $4.50.
Maximow, A. A., & Bloom, Wm.	Textbook of histology. Philadelphia, Saunders, 1934. $7.00.
McBride, W. C.	Juvenile dentistry. Philadelphia, Lea & Febiger, 1932. $2.75.
McCaw, Emma J.	Dental assistant. St. Louis, Mosby, 1926. $1.50.
McCollum, E. V., & Becker, Ernestine	Food, nutrition and health. Baltimore, Authors, 1933. $1.50.
McCollum, E. V., & Simmonds, Nina	Newer knowledge of nutrition. New York, Macmillan, 1929. $4.00.
McCoy, J. D.	Applied orthodontia. Philadelphia, Lea & Febiger, 1931. $4.50.
McGehee, W. H. O.	Textbook of operative dentistry. Philadelphia, Blakiston. 1930. $10.
Mead, S. V.	Diseases of the mouth. St. Louis, Mosby, 1932. $10.00.
Mead, S. V.	Oral surgery. St. Louis, Mosby, 1933. $12.50.
Mellanby, May	Diet and the teeth: an experimental study. Part I. Dental structure in dogs. London, His Majesty's Stationery Office, 1929. $7.00.
Mellanby, May	Diet and the teeth: an experimental study. Part II. A. Diet and dental disease. B. Diet and dental structure in mammals other than the dog. London, His Majesty's Stationery Office, 1930. $1.00.
Merritt, A. H.	Periodontal diseases: diagnosis and treatment. New York, Macmillan, 1930. $4.00.
Moorehead, F. B., & Dewey, Kaethe W.	Pathology of the mouth. Philadelphia, Saunders, 1925. $7.00.
Neil, Ewell	Full denture practice. Nashville, Tenn., Marshall and Bruce Co., 1932. $3.50.
Nevin, Mendell, & Puterbaugh, P. G.	Conduction, infiltration and general anesthesia in dentistry. Brooklyn, Dental Items of Interest Pub. Co., 1927. $6.00.
Nichols, I. G.	Prosthetic dentistry: an encyclopedia of full and partial denture prosthesis. St. Louis, Mosby, 1930. $12.50.
Ochsner, E. H.	Social insurance and economic security. Boston, Bruce Humphries, 1934. $2.50.
Okumura, Tsurukichi	Present status of dentistry in Japan. Tokyo, Japan, Japan Dental Assn., 1931. (Pamphlet.) (No purchase orders accepted.)
Orban, Balint	Dental histology and embryology. Philadelphia, Blakiston, 1929. $5.00.
Osgood, H. A.	Teeth and jaws roentgenologically considered. Annals of roentgenology, volume 5. New York, Hoeber, 1929. $10.00.
Ottolengui, Rodrigues	Table talks on dentistry. Brooklyn, Dental Items of Interest Pub. Co., 1928. $7.00.
Palmer, G. T., Derryberry, Mahew & Van Ingen, Philip	Health protection for preschool child: national survey of use of preventive medical and dental service for children under six. New York, Century, 1931. $2.50.
Perry, Maude A.	Dietetics and nutrition. St. Louis, Mosby, 1930. $2.50.

Phelps, Edith M.	Socialization of medicine. New York, Wilson, 1930. $0.90.
Pollia, J. A.	Fundamental principles of alveolo-dental radiology. Brooklyn, Dental Items of Interest Pub. Co., 1930. $8.00.
Posner, J. J.	Minor oral surgery simplified. Philadelphia, Patterson & White, 1928. $2.00.
Prinz, Herman	Dental formulary. Philadelphia, Lea & Febiger, 1930. $3.50.
Prinz, Herman	Dental materia medica and therapeutics. St. Louis, Mosby, 1926. $7.50.
Prinz, Herman	Diseases of soft structures of teeth. Philadelphia, Lea & Febiger, 1928. $6.50.
Prothero, J. H.	Prosthetic dentistry. Chicago, Medico-Dental Pub. Co., 1928. $10.00.
Pusey, W. A.	Doctor of the 1870's and 1880's. Baltimore, C. C. Thomas, 1932. $3.00.
Quigley, D. T.	Notes on vitamins and diets. Chicago, Consolidated Book Publishers, Inc., 1933. $1.00.
Raper, H. R.	Clinical preventive dentistry. Rochester, N. Y., Ritter Dental Mfg. Co., 1926. $3.50.
Rapp, F. W.	Elements of anatomical articulation or the mathematics of dental prosthetics. London, Bale, 1930. $2.00.
Ray, K. W.	Metallurgy for dental students. Philadelphia, Blakiston, 1931. $3.00.
Report of Committee on Growth and Development	Growth and development of the child. Part III. Nutrition. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $4.00.
Report of Committee on Public Health Organization	Public health organization. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $3.00.
Reports of Subcommittees on Nutrition and Health Centers	Nutrition service in the field. Child health centers: a survey. (A publication of White House Conference on Child Health and Protection.) New York, Century, 1932. $2.00.
Roberts, Lydia J.	Nutrition work with children. Chicago, University of Chicago Press, 1927. $3.50.
Rose, Mary S.	Foundations of nutrition. New York, Macmillan, 1927. $2.75.
Rubinow, I. M.	Quest for security. New York, Holt, 1934. $3.50.
Rukeyser, M. S.	Doctor and his investments. Philadelphia, Blakiston, 1931. $2.50.
Schroff, Joseph	Fundamentals of pathology. New York, W. A. Broder, 1929. $2.50.
Scruggs, A. M.	Glory of earth. (A book of poems by a dentist.) Oglethorpe Univ., Press, 1933. $2.00.
Sears, V. H.	Full denture procedure. New York, Macmillan, 1929. $2.00.
Seldin, H. M.	Practical anesthesia for dental and oral surgery. Philadelphia, Lea & Febiger, 1934. $7.00.
Shaw, D. M.	Dental prosthetic mechanics. London, Arnold, 1927. $7.50.
Sherman, H. C.	Vitamins. New York, Chemical Catalogue Co., Inc., 1931. $6.00.
Sicher, Harry, & Tandler, Julius	Anatomie für Zahnärzte. Vienna, Julius Springer, 1928. (No purchase orders accepted.)
Silverman, S. L.	Principles and practice of oral surgery. Philadelphia, Blakiston, 1926. $6.00.
Simon, P. W.	Fundamental principles of systematic diagnosis of dental anomalies. Boston, Stratford, 1926. $5.00.
Simon, W., & Base, Daniel	Manual of chemistry. Philadelphia, Lea & Febiger, 1927. $5.00.
Simons, A. M., & Sinai, Nathan	Way of health insurance. Chicago, University of Chicago Press, 1932. $2.00.
Simpson, C. O.	Advanced radiodontic interpretation. St. Louis, University Press, 1931. $25.00. (Because of the unusual price and its lack of durability a rental fee of $1.00 will be charged for this book for each two weeks it is in circulation.)
Simpson, C. O.	Technic of oral radiography. St. Louis, Mosby, 1928. $5.00.
Simpson, C. O.	Toothsome topics. St. Louis, University Press, 1931. $2.50.
Skinner, E. W.	Dental materials and technology. Cleveland, Ohio, Author, 1933.

Smith, D. T.	Oral spirochetes and related organisms in fusospirochetal disease. Baltimore, Williams & Wilkins, 1932. $4.50.
Smith, G. F. R.	Dental anaesthesia. Outlines of dental science. Vol. 1. Edinburgh, Livingstone, 1926. $2.50.
Smyth, Corisande, & Young, Matthew	Facial growth in children. London, His Majesty's Stationery Office, 1932. $0.75.
Sorrin, Sidney, & Miller, S. C.	Practice of periodontia. New York, Macmillan, 1928. $3.50.
Steadman, F. St. J.	Pyorrhea alveolaris. St. Louis, Mosby, 1927. $9.25.
Stibbe, E. P.	Anatomy for dental students. Baltimore, Wood, 1934. $6.00.
Stieglitz, Julius	Chemistry in medicine. New York, Chemical Foundation, 1928. $2.00.
Stillman, P. R., & McCall, J. O.	Textbook of clinical periodontia. New York, Macmillan, 1927. $4.50.
Stillson, W. C.	Dental anatomy: classroom and laboratory quiz compend with supplementary notes. Philadelphia, Saunders, 1929. $2.25.
Stoloff, C. I.	Your teeth. New York, Dutton, 1929. $2.50.
Strang, R. H. W.	Textbook of orthodontia. Philadelphia, Lea & Febiger, 1933. $10.00.
Sure, Barnett	Vitamins in health and disease. Baltimore, Williams & Wilkins Co., 1933. $2.00.
Suter, A. B. W.	Dentistry—a profession and a business. Rochester, N. Y., Ritter Dental Mfg. Co., 1930. $7.50.
Tanguy, T. V.	Science and practice of actinotherapy. St. Louis, Mosby, 1928. $3.00.
Thoma, K. H.	Clinical pathology of the jaws. Springfield, Ill., C. C. Thomas, 1934. $9.00.
Toverud, K. U., & Toverud, Gottorm	Studies on the mineral metabolism during pregnancy and lactation and its bearing on the disposition to rickets and dental caries. Uppsala, Almqvist & Wiksells Boktryckeri-A-B, 1931. (Pamphlet.) (No purchase orders accepted.)
Turner, C. R., & Anthony, L. P.	American textbook of prosthetic dentistry. Philadelphia, Lea & Febiger, 1932. $10.00.
Tyree, C.	Dental health in the prevention of disease. London, Kentucky, Author, 1927. $2.75.
Ullmann, E. V.	Diet in sinus infections and colds. New York, Macmillan, 1933. $2.00.
Urling, L. H.	Your teeth; their care and preservation. Philadelphia, Dorrance, 1932. $1.50.
Vines, H. W. C., & Lynch, K. M.	Green's manual of pathology. Baltimore, Wood, 1934. $6.50.
Wallace, J. S.	Physiology of oral hygiene and recent research. London, Bailliere, Tindall & Cox, 1929. $4.00.
Wallace, J. S.	Teeth and health. London, Faber & Gwyer, 1926. $1.40.
Wallace, J. S.	Variations in the form of the jaws, with special reference to their etiology and their relation to the occlusion of the dental arches. New York, Wood, 1926. $6.00.
Ward, M. L.	American textbook of operative dentistry. Philadelphia, Lea & Febiger, 1926. $10.00.
Webster, A. E.	Manual for dental assistants. Philadelphia, Lea & Febiger, 1932. $3.50.
Weinberger, B. W.	Orthodontics: an historical review of its origin and evolution. 2 vols. St. Louis, Mosby, 1926. $25.00.
Wilensky, A. O.	Osteomyelitis, its pathogenesis, symptomatology and treatment. New York, Macmillan, 1934. $9.00.
William, Maurice	Sun Yat-Sen versus communism. New evidence establishing China's right to the support of democratic nations. Baltimore, Williams & Wilkins, 1932. $5.00.
Williams, Pierce, & Chamberlain, Isabel	Purchase of medical care through fixed periodic payment. New York, National Bureau Economic Research, 1932. $3.00.

Winter, Leo	Principles of exodontia, as applied to the impacted mandibular third molar. St. Louis, American Medical Book Co., 1926. $15.00.
Winter, G. B.	Textbook of exodontia. St. Louis, Mosby, 1931. $10.00.
Wolfenden, H. H.	Real meaning of social insurance. Toronto, Canada, Macmillan, 1932. $2.00.
Woodbury, C. E.	Making and filling of cavities in the proximal surface of the front teeth with gold foil. Omaha, Neb., Author, 1929. $5.00.
Woodhouse, C. G., & Schiffman, Ruth Y.	Dentistry: its professional opportunities. Greensboro, N. C., Woman's College of Univ. of North Carolina, 1934. $1.00.
Zemsky, J. L.	Oral diseases: practical treatise offering diagnostic and therapeutic aid to the practitioner of medicine and dentistry. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $8.00.
Zemsky, J. L.	Outline of oral surgery. Brooklyn, N. Y., Physicians and Surgeons Book Co., 1930. $4.50.
Zoethout, W. D.	Textbook of physiology. St. Louis, Mosby, 1928. $4.50.

The Dental Creed

Copies of the creed are available in form suitable for framing from the Library Bureau of the American Dental Association, 212 E. Superior St., Chicago, at 50 cents each. They are 10 by 15 inches and are printed on high grade paper in brown ink. The initial letter may be obtained in red or green, as preferred. Each copy is signed by the author. This creed appeared as an editorial in the August, 1934, issue of The Journal. Kindly send remittance with order.

Written Instructions for Your Denture Patients

A fourth printing of "Your New Teeth," a booklet for denture patients, has just come off the press. This booklet is intended primarily for the patient who is wearing dentures for the first time. It enumerates some of the difficulties that may be encountered when one first wears dentures and offers suggestions as to how these difficulties may be overcome. There is also much of interest to the patient who has been wearing dentures, as information is given regarding the care, repair and rebasing of dentures. The information in this booklet was taken from the article entitled "Instructions for the Edentulous Patient," by B. L. Hooper, which was published in The Journal, February, 1932. The price of these booklets is: 25, $1.00; 50, $1.50; 100, $2.00. Kindly send remittances with order. A sample of booklet will be sent on request.

Orthodontia Editorial

A few more copies of the tribute to orthodontia, which originally appeared as an editorial, may be obtained. This editorial is reprinted in form suitable for framing, on good quality paper, measuring 10 by 15 inches. The print is brown with the initial in green or red, as preferred. The editorial is signed in brown by the author. The cost per copy is 50 cents. Send your order and remittance to the Library Bureau.

Printed List of Package Libraries

Package libraries on nearly 300 phases of dentistry have been compiled. These packages each contain from ten to sixty articles, averaging about twenty. The rental fee for a package is 50 cents. The printed list contains about the same headings as appeared in the list published in The Journal, May, 1934. A copy of this list will be mailed on request without charge.

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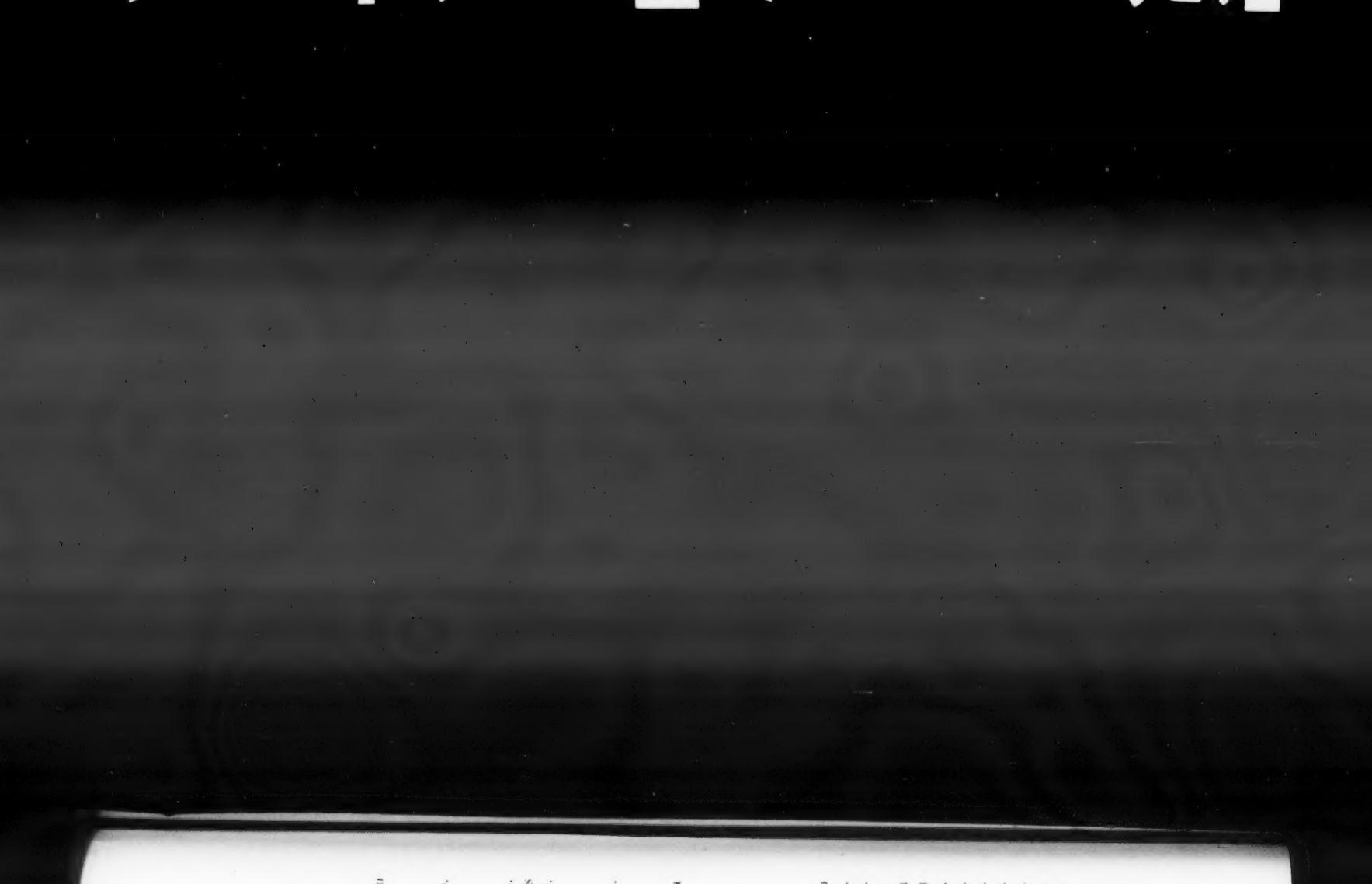
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